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Details of New Bottle Machine by Lynch

A BRIEF description of the new Lynch model 10 has already appeared in these pages (May issue) and we now have pleasure in presenting to our readers a slightly more specific account, together with some excellent illustrations provided by the Lynch Corporation.

It will be recalled that among the important features of the new machine are the following points:

The blow heads are individual to each mold and travel with the mold, so that the blowing is maintained during both the traveling and "dwell" period and not simply during the brief period of the "dwell" as is the case when blow heads are provided simply at a couple of stations.

By reason of this system of blowing, the dwelling period can be made very short and the moving period long, which results in a very slow velocity even at an increased speed or bottles per minute. This fact is taken advantage of to incorporate a new type of intermittently-indexing mechanism.

Thereby also it becomes possible to provide individual adjustment of the blow period for each separate mold. This gives a somewhat greater flexibility when working a number of different molds simultaneously on the one machine and these adjustments can be made while the machine is in motion.

In Fig. 1 we have a general assembly of the machine shown in vertical section: the molds of course are omitted. In Fig. 2 is shown a plan view of the basal part of the machine and in Fig. 3 a plan view of most of the upper mechanisms. In all these views the feeder end is to the left and the take out mechanism to the right.

In Fig. 1 is shown the base casting 1001 with two columns, 1050 (blank column) to the left and 1225, the blow mold column, to the right.

Around the lower part of each column is assembled the rotating deck (1052 and 1234) while around the upper part are assembled the stationary cam tracks and other mechanisms that control most of the motions of the molds.

The function of the rotating deck of course is simply to provide a means for transporting the molds from one station to another, inverting them, opening and closing them as needed.

Accordingly the mechanism immediately above the deck on the left hand column consists essentially of the blank mold carriers and the rather complex construction necessitated by the invert mechanism. It will be seen that this invert assembly is supported in a large roller bearing at the front or outside, and a smaller ball bearing on the inside (nearer the column) while the bevel gear 1092 which meshes with 1090 above it to effect the actual inversion, is midway between the bearings. This construction is obviously very much more satisfactory than the plain cast iron bearing and overhung construction of other models. The invert mechanism is held in locked position by index pin 1173 to keep the mold vertical when the bevels are out of contact. It is raised for the inverting process by cam roller 1178 running on cam surface 1169, and is returned by spring 1172.

The blank mold is opened and closed by yoke 1061 and its assembly. The cam follower is the roller 1059 and its manner of action needs no explanation. There is a yielding connection between the cam follower and the yoke so that in case of emergency, spring F 58 can be brought into action and danger to the machine prevented.

Vacuum is used for forming the finish, applied by vacuum head 1161 shown on Fig. 1 at the extreme left which is also the charging position. This mechanism is air operated and timed so that just as the glass "gob" or charge is entering the blank mold, the vacuum is applied. As the blank mold leaves this charging station, the valve is reversed and the vacuum is cut off.

Each blank mold carrier also carries its own baffle plate and plunger.

Plungers are secured to the end of rod 1132 and move up and down in plunger box 1136; these plungers are held out of position by spring 1135 (marked in inverted position near center of Fig. 1) and are moved up or into position by plunger cylinder 1123, which is also positioned at the charging station.

Just after the blank carrier leaves the charging station, the baffle plate, which is secured to the end of rod 1197 (see Fig. 4), is moved directly over the open end or top of blank mold and then lowered into engagement with same. These

(*Continued on page* 123)

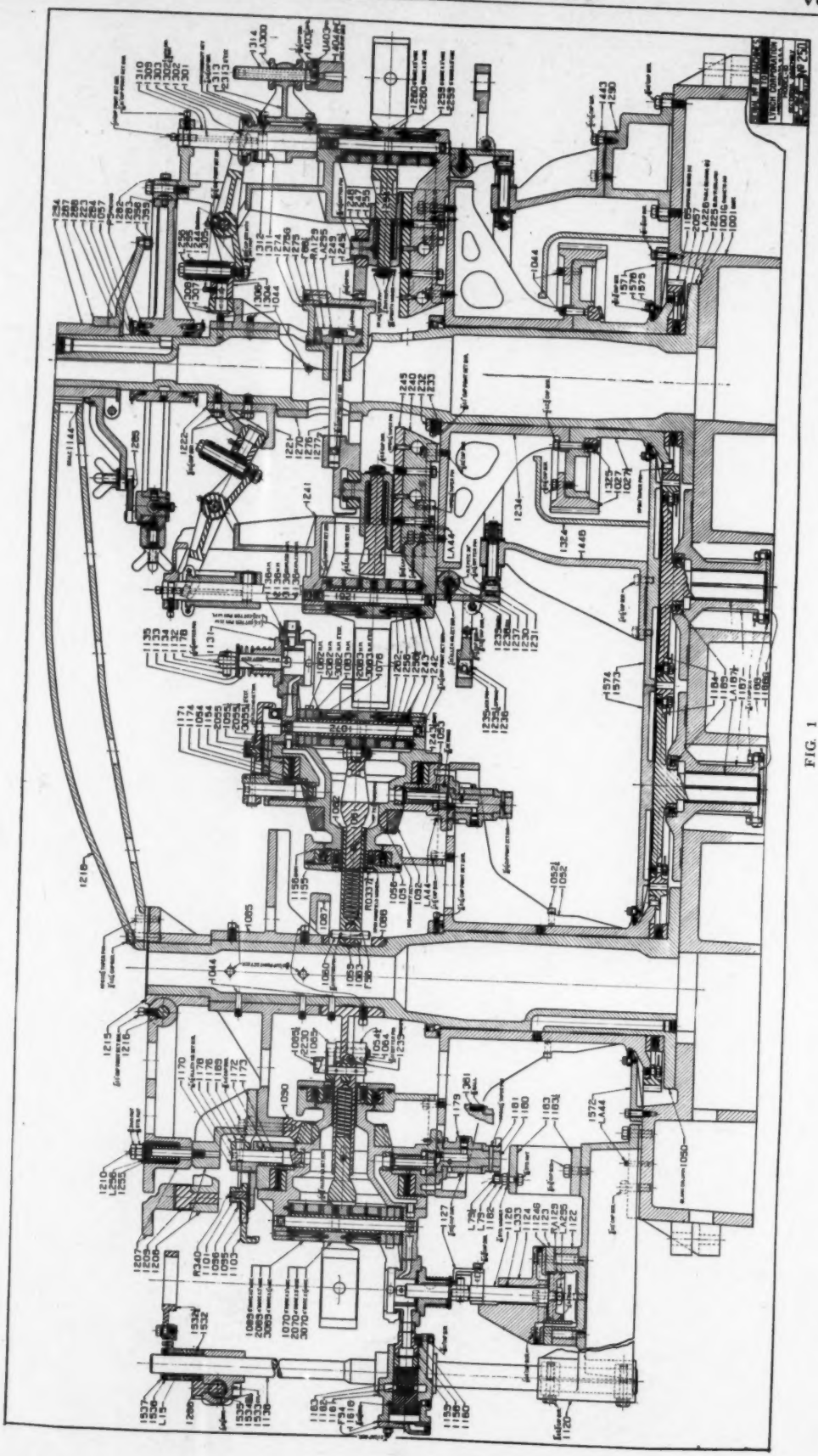


FIG. 1

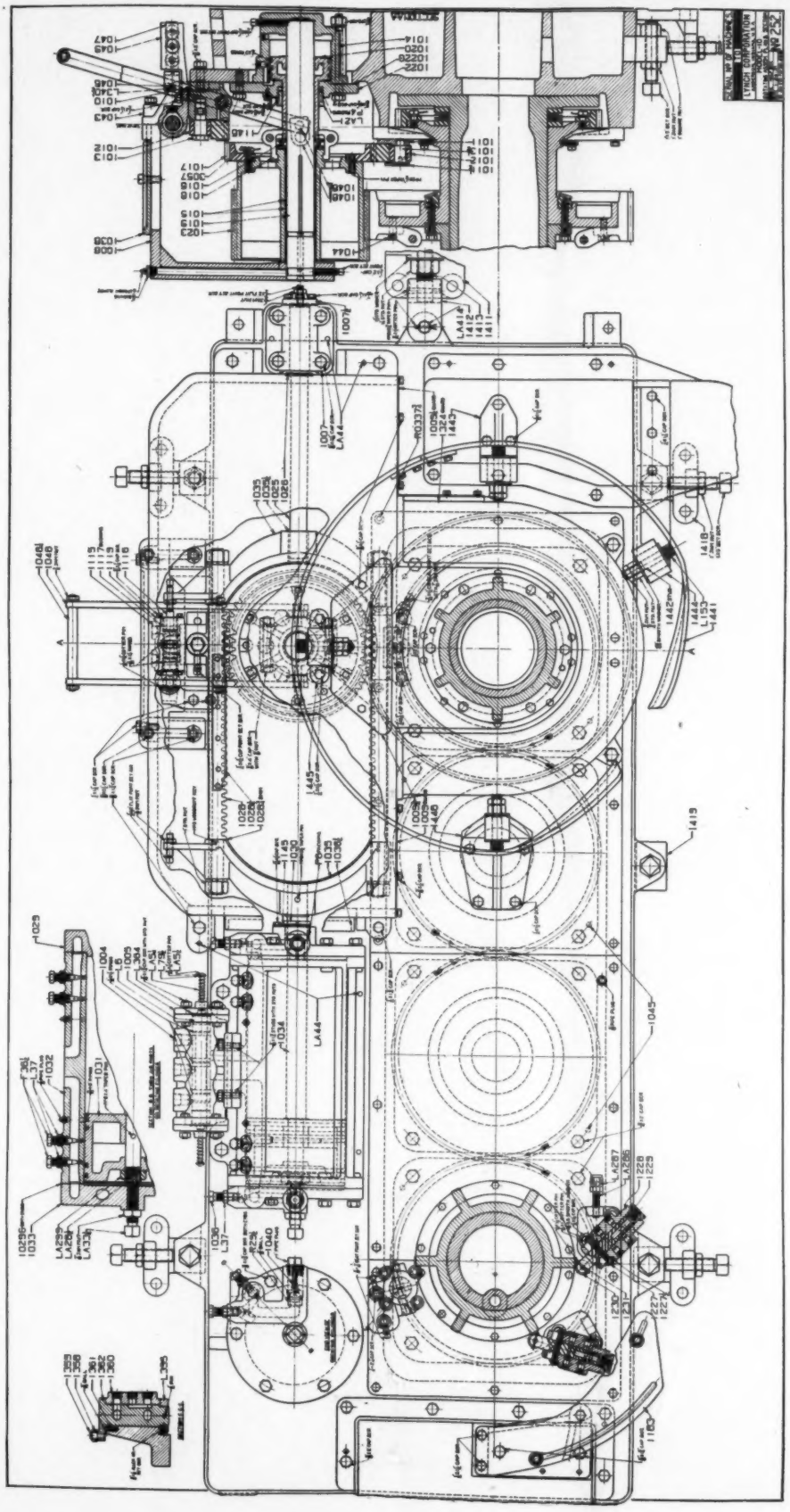


FIG. 2A

FIG. 2

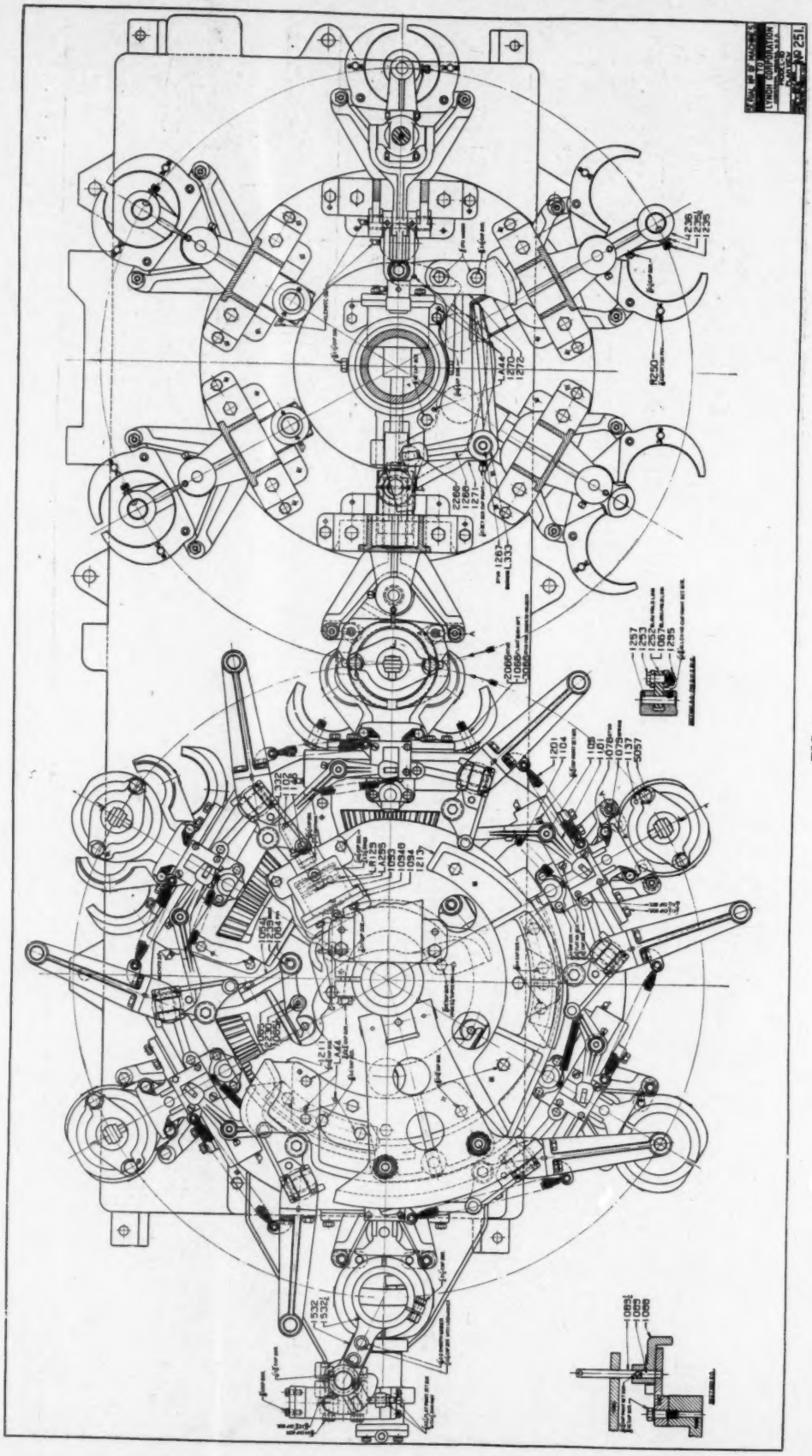


FIG. 3

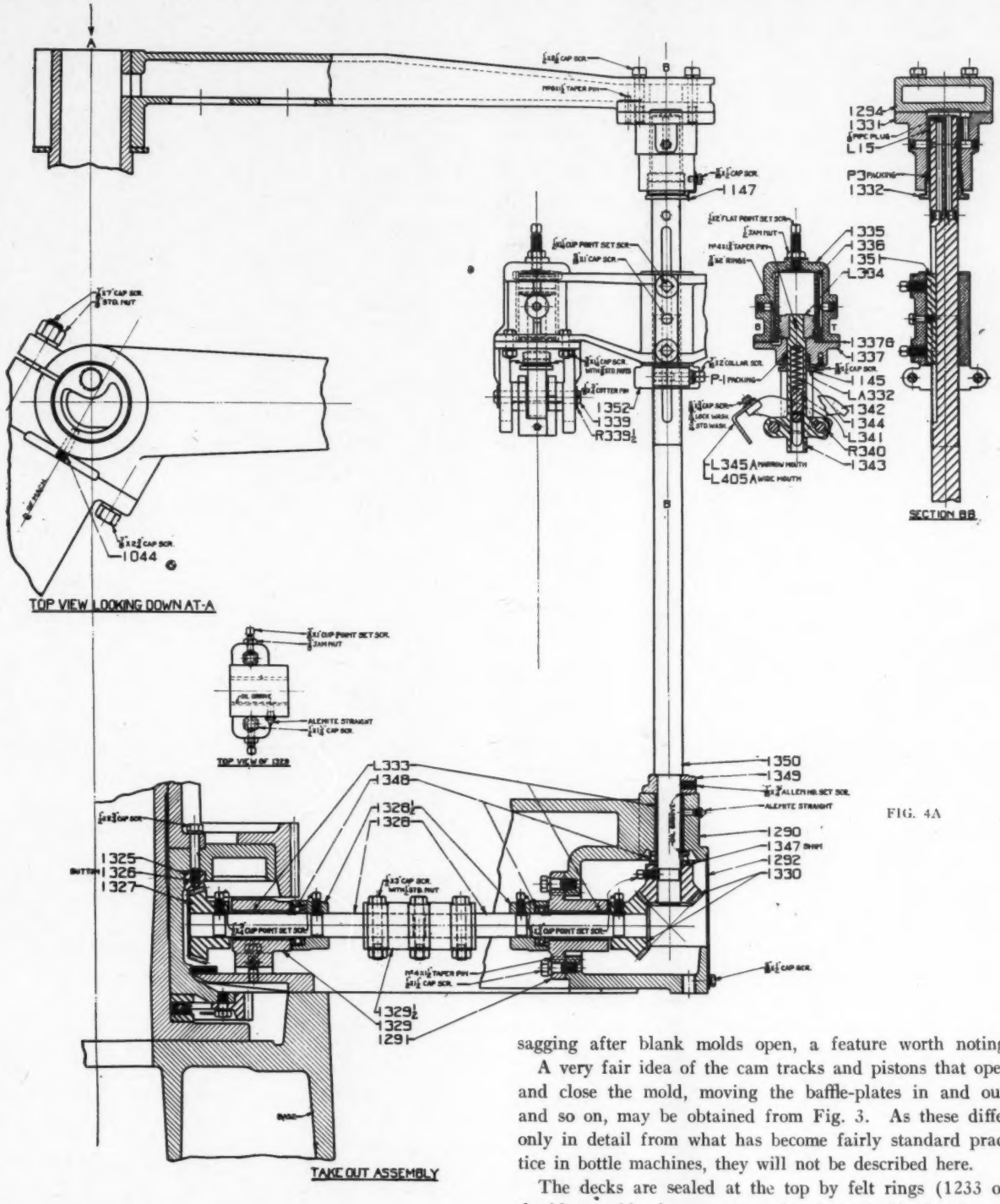


FIG. 4A

movements are obtained by means of cam and cam roller which are clearly shown on Fig. 3.

Under each blank mold carrier is a valve 1179 which controls the counter blowing of parison. The adjustments for blowing can be made while carriers are in motion.

Finish ring holders 1082 and 1083 are dovetailed around plunger box 1136, which keeps finish ring bushings and plungers lined up and also prevents finish ring holders from sagging after blank molds open, a feature worth noting.

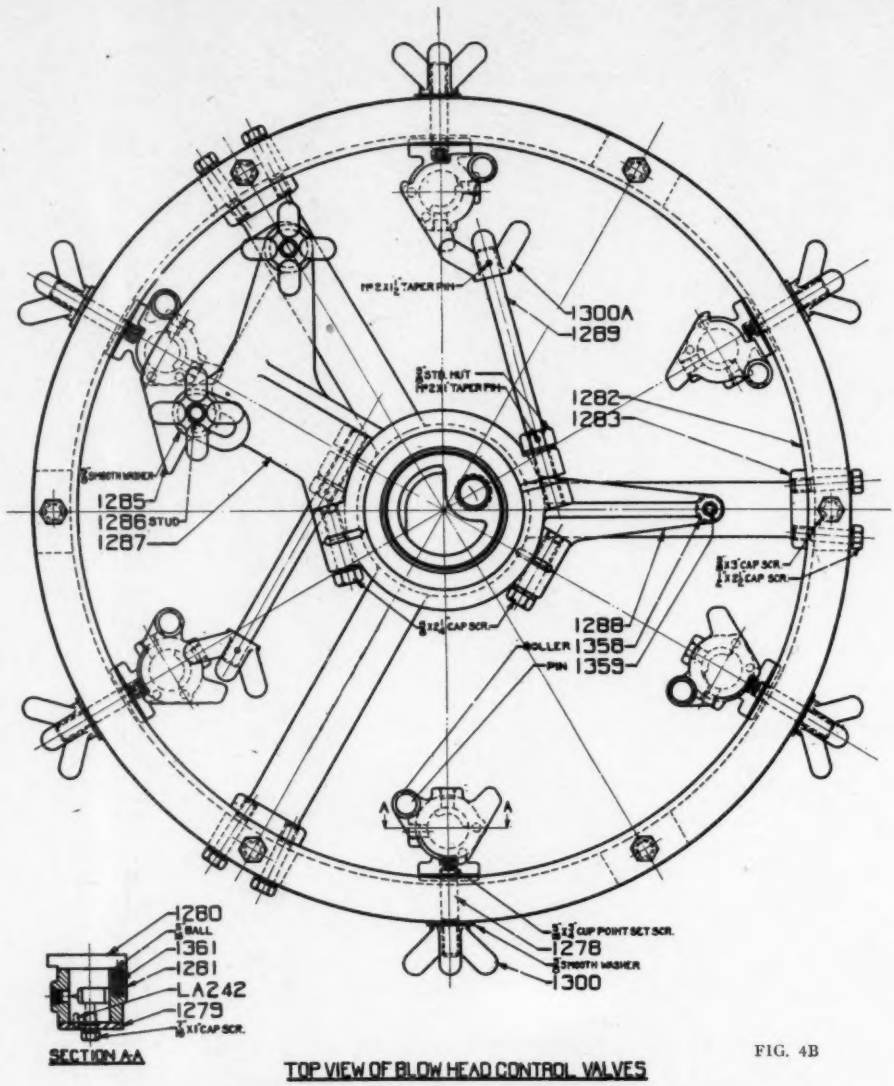
A very fair idea of the cam tracks and pistons that open and close the mold, moving the baffle-plates in and out, and so on, may be obtained from Fig. 3. As these differ only in detail from what has become fairly standard practice in bottle machines, they will not be described here.

The decks are sealed at the top by felt rings (1233 on the blow mold column, not numbered on the blank column) and at the bottom by other rings 1575. Their weight is carried on ball bearings LA 226, which run in a recess on the base casting. This recess extends completely from one column to the other and in it run four equal ring gears, 1185, mounted on the deck casting, and 1184, a pair of idlers serving to gear the decks together. The gears, all hardened and ground, are decked over with plates 1573 and 1574, and the recess is

filled with oil, thus ensuring that this important synchronizing mechanism is kept away from wear and in the best possible condition for preserving the accuracy of the adjustment.

On the blow mold deck the mold jaws pivot on hardened and ground pins 1261, corresponding with 1072 on the blank mechanism, and the cam follower for opening and closing them is 1249. The blow heads are raised and lowered by the cam follower 1307, which works against the cam castings 1221 and 1222. Here again we have a yielding element (the spring 1225), which can give if for any reason some abnormal resistance is encountered by the blow head. The castings above this level (1282, etc.) are used to carry to blow head control valves 1280 and their operating cams, 1285, so that, as stated before, the duration and incidence of the blow on each mold, may be individually varied.

The deck casting around column is cut in two horizontally and near the joint are two gears, the bull-gear 1027 and the bevel 1325.



TOP VIEW OF BLOW HEAD CONTROL VALVES

FIG. 4B

The bevel gear meshes in a 3 to 1 ratio with 1327 (Fig. 4) which shows the take out assembly, and since gears 1330 are equal miters, shaft 1350 makes a half revolution each time the blow mold table advances by one station (the machine carries six molds to a deck). The details of the take out mechanism, a pair of double acting cylinders 1335, air operated, call for no special comment, though containing ingenious features. (One of which is that the cylinders and bracket is made from aluminum alloy and the cylinder bores have ground steel bushings to take the wear.)

The bull wheel is the primary source of motion of the two decks. It is driven (see Fig. 2A) through the long faced gear 1023. This latter gear has bolted to its lower face the first-motion or shift gear 1017 which can mate with either of two racks 1028 (Fig. 2) one rack being higher than the other, so that the gear can be raised or lowered out of contact with the one in order to mesh with the other. Raising and lowering is done by the piston 1020 (Fig. 2A).

The two racks form together a sort of yoke or frame, driven by piston rod 1034 (Fig. 2) and both racks move together at each stroke of this piston. The racks reverse their direction at each stroke and while they dwell, piston 1020 changes the mating gear 1017 from one rack to the other. Thus every stroke of the piston 1031 rotates the gear in the same direction and by an exact amount, corresponding to the movement of the decks from one station to the next. Cushioning arrangements are provided for slowing down the movement towards the end of the stroke, and these are entirely effective in giving a smooth action to the machine as a whole.

It will be observed that the effort of turning the long faced gear 1023 does not come on the shaft 1019, but that the gear 1017, transmitting the effort, is bolted directly to 1023. Thus the shaft serves merely as a post or bearing on which the two gears can rise and fall and turn. This is obviously a very rigid and sound construction, since the whole driving effort of the machine is exerted here.

Space does not permit us to go into further detail of the machine, which the reader may with advantage study from the illustrations.

Greatest Venture In Mirror Making Ever Attempted

Sprayed quartz supersedes glass for fashioning a 66-inch telescope disc, 15 inches in thickness. The newly developed process will be used in the making of the 200-inch mirror for the California Institute of Technology*

By JOHN W. HAMMOND, General Electric Company

HOT, searing "sleet," somewhat like a winter's sleet storm in reverse, has rained down steadily within a fiery furnace, and the largest mass of fused quartz ever produced upon the earth has thus been brought into existence. The quartz mirror makers of General Electric have completed their first experiment in turning out fused quartz on a large scale. The mass is five feet in diameter, a foot in thickness, and it weighs 4,000 pounds. It was made at the "furnace house" adjoining the Thomson Research Laboratory of the company at West Lynn, Mass. Because of imperfections incident to the experimental nature of the work, it is not in itself satisfactory for finishing into a mirror, but the experiment of making it resulted in the perfection of the process. The laboratory staff now knows how to produce large masses of quartz and make them perfect, which augurs success for the huge slab to be used in the 200-inch astronomical mirror of the California Institute of Technology.

A year ago these pioneers in a new craft melted a disc of quartz twenty-two inches in diameter. Then they sprayed its face with powdered quartz which rained down in the billowy flame of an oxygen-hydrogen burner—the "high-temperature sleet storm"—and deposited a surface glass-like in appearance. The blank just made is sixty-six inches across. It has been formed entirely by the spraying method, layer after layer flowing from the burner in a stream to be melted by the intense heat, and then "freezing" solid before going through weeks of careful annealing.

To advance from a diameter of 22 inches to one of 66—an increase of 25 times in mass—might seem like the progress of a tortoise. But Professor Elihu Thomson, director of the Thomson Research Laboratory of the General Electric Company and the chief of the quartz melters, asserts: "The step from sixty-six inches to one hundred inches, and then to two hundred inches, will be much more readily taken than was the step from twenty-two inches to sixty-six inches."

This can be easily comprehended, for to go from twenty-two to sixty-six a whole new building had to be erected. A giant circular furnace pit had to be designed and constructed, with special flooring of silica brick and a lining of silica and fire brick. A sturdy electric crane, capable of lifting 135,000 pounds, had to be assembled within the building and equipped with a "spider" hook-ring for lifting the cover from that shimmering interior. An intricate feeding mechanism, mounted on a traveling carriage, had to be contrived. Into this supply lines merge, and within it powdered quartz and hydrogen gas meet under pressure, to pass directly to the burner deep within the fiery chamber, with oxygen constantly flowing through the spaces between the burner tubes. And a prolonged process of reducing the quartz from rock crystal to the purest powder of a definite grain size had to be developed, including the careful training of men whose experience of the past twelve months has made them veritable specialists in the working of silica.

Out of the solving of many such problems this five-foot quartz slab has come. Most of the problems are now solved permanently. The basic process is established for the giant slabs still to follow. But long study, long hours, night work as well as day work, incessently month after month absorbed the talents of Professor Thomson's technical staff—chief of whom is A. L. Ellis, assistant director of the laboratory, the manager of the work—before every dilemma had been overcome.

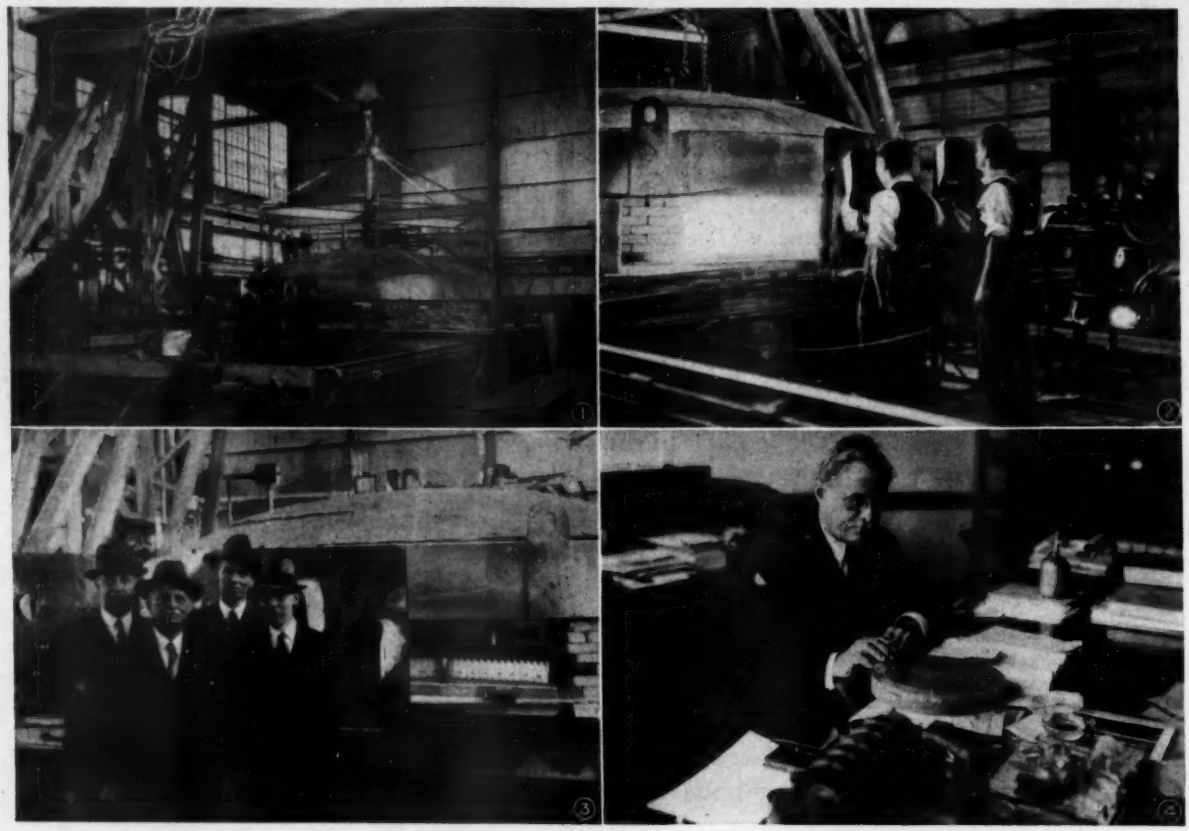
At first a base slab was to be melted in a carbon-resistance furnace, as was done with the previous discs, and then the surface coating sprayed on. It meant a furnace of enormous size, a working temperature one-third as high as the temperature on the surface of the sun. Then, casting precedent aside, Ellis adopted the idea of fashioning the entire disc by spraying, for he and his men had gained new knowledge of the spray method in coating the twenty-two inch discs.

The forward step thus accomplished represents a splendid engineering feat. Up to this time the only experience in spraying quartz was the laying down upon a 22-inch disc of a surface coating of quartz 5/8ths inch thick. The mass of quartz in the 66-inch disc, *built up solely by spraying*, weighs over 4,000 pounds and is nearly 15 inches thick. It represents a volume 225 times greater than that laid down on the 22-inch mirror. In engineering, generally speaking, a forward step of ten to one is considered very great. Measured by that criterion, the step in going from a fused quartz disc of 22 inches to one of 66 inches, with the attendant advance in the use of the spraying method, was gigantic.

The net result is that the fusing of this blank has been probably the biggest single step that will have to be taken toward the production of the 200-inch mirror. The step from the mass just produced to the production of the mass for the 200-inch mirror will be but 22 to 1, instead of 225 to 1, and practically every matter about which there has been any doubt will have been solved.

A queer, high-pitched structure of composition sheet metal

*Submitted for publication by General Electric Company, April 7, 1931.



1. IN THE FURNACE ROOM, SHOWING THE COVER-LIFTING MECHANISM IN PLACE. 2. WATCHING THE SPRAYING PROCESS WHILE MAKING THE FIRST 60-INCH QUARTZ BLANK. 3. A. L. ELLIS, DR. ELIHU THOMSON, DR. WALTER S. ADAMS AND H. L. WATSON BEFORE THE FURNACE USED FOR SPRAYING THE 60-INCH QUARTZ BLANK. DR. ADAMS IS DIRECTOR OF THE MT. WILSON OBSERVATORY; THE OTHER MEN ARE OF THE THOMSON RESEARCH LABORATORY. 4. DR. ELIHU THOMSON, DIRECTOR OF THE THOMSON RESEARCH LABORATORY OF THE GENERAL ELECTRIC COMPANY, INSPECTING ONE OF THE FIRST, SMALL QUARTZ DISCS MADE AT LYNN, MASS.

bolted together and capable of being taken apart and enlarged at will contains the caldron-like crucible in which quartz is treated as it never has been treated in nature since the earth existed. A steady droning hum falls upon the ear the moment one steps inside the door. It is the ceaseless monotone chant of eight hundred kilowatts of electricity passing through control devices and thence into the heating elements of the twelve-foot furnace chamber. A penetrating summer-like warmth becomes instantly apparent, radiating from the circular compartment in the center of the wide room; while ascending constantly in a steady shimmer are the waves of heated air, that shake and tremble like ghosts in anguish.

And within that fiery pit? Heat in Fahrenheit degrees twenty times higher than the hottest summer day at 95! Heat that sends forth a bright glow of the deepest lemon yellow, that sets a-quiver the interior of the furnace chamber like vibrating undulations moving through a translucent liquid of vivid dye.

Embedded within this torrid bath lies the slab, with the burner moving slowly over its face, spouting the quartz "sleet," at a temperature approaching 4,000 degrees Fahrenheit. The spot where the burner is working is always about 1,500 degrees hotter than the furnace itself. Encasing the burner is a shield of fused quartz and the burner is attached to a stout brass pipe within which are the tubes carrying the powdered quartz and the hydrogen and oxygen, as well as water-cooling tubes to keep the entire burner from melting.

This surprising experiment in mirror-making demonstrated the great structural stability of quartz as compared with glass. In annealing, or cooling, a glass disc of similar dimensions—a 72-inch slab recently made for the Bureau of Standards—between eight and nine months were consumed before the glass was completely cooled.

Knowing the magnitude of the stresses created by changes of temperature in glass structures in relation to the size of the piece of glass, laboratory technicians have calculated that a great slab of 200 inches would require six years to anneal if made from a form of soft glass. If made from hard glass somewhat like Pyrex, which would be more probable, the time necessary for annealing would be nearly nine years. In addition to this there would be the period of grinding and polishing, which lasted two years with the 100-inch mirror of the Mount Wilson Observatory. To grind and polish to a complete figure a surface area four times as great would take at least twice as long.

Finally, in the very first stage of glass work, a long period of time would probably be taken up in attempts to

obtain a perfect pouring of sufficient molten glass to yield a 200-inch disc. It seems probable that altogether nearly fifteen years might elapse before a 200-inch glass mirror could be turned out. The quartz mirror of this size will take only a fraction as long. Indeed, the entire period of quartz work, including the fusing of the four preliminary sizes, will scarcely be more than one-third as long.

The fusing of a second blank of the 66-inch size will begin at once, and there is every confidence that this new disc when completed can be given the finished mirror surface. Every essential element is understood not only for making the 66-inch size but also the 200-inch disc. It is known that the furnace can be operated long enough to produce a 200-inch mirror blank; that water-cooled brass tubing and brass castings comprise a dependable burner for the spraying; that the spraying of large masses of fused quartz can be stopped and started at will. It is understood how to produce sufficient quantities of oxygen and hydrogen for the 200-inch process; how to control the feeding of pulverized quartz in large quantities; how to build up large masses of fused quartz by spraying.

The success of the undertaking, creating eventually a 200-inch astronomical mirror, will open, as it were, a door, under the most promising conditions in the history of astronomy, to an area of unexplored space thirty times greater than that at present known.

From glass to quartz is the transition which the builders of star-gazing telescopes perceive on the horizon. The trick of making a huge mirror out of fused quartz has been mastered, and new possibilities are presented to astronomers.

Data on the Resistance of Metals Suitable for Dies to the Abrasive Action of Plastic Clay[1]

The object of the investigation is to obtain data on the relative "wear values" of metals when subjected to abrasion by the continuous flow of plastic clay such as occurs in dies for molding stiff mud clay columns. The preliminary work was completed early in the year and sixteen metals and alloys have been tested. The abrasive material is a mixture of 60 parts of plastic clay and 40 parts of silica sand. Fifteen per cent of water is added and the mass is tempered to a "stiff mud" condition.

The volume of the plastic clay-sand mixture extruded through the orifice of the die specimen is constant for all tests and is extruded at a constant volume rate. The extrusion pressures cannot be governed closely inasmuch as they vary over a comparatively wide range for slight changes in the moisture content of the clay-sand mixture. A small decrease in moisture content causes a large increase in extrusion pressure. As the extrusion pressure increases, the wear loss also increases. It was therefore necessary to determine the relation between abrasion loss of the specimen and the extrusion pressure so that the comparative wear values could be determined for the different metals and alloys tested. Up to the beginning of the present year, the data obtained indicated that the abrasion loss and the extrusion pressure were directly proportional. However, later data obtained indicated that the relation is parabolic according to the equation:

$$y^2 = \frac{CX}{K^2}$$

in which:

y = the abrasion loss of the specimen.
X = the extrusion pressure.
C = a constant.
K = the relative "wear value" of the material.

In the following table are given the relative K values, each representing the average of eight tests for fifteen of the materials tested. These values are calculated on a basis of unity for the material showing the least resistance to abrasion and represent the relative lengths of clay columns that can be extruded from dies of these materials which will produce the same amount of abrasion loss in each case.

[1] Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

RELATIVE WEAR VALUES

Material	*K*
Zinc manganese bronze	1.00
Electrolytic copper	1.72
Rustless steel	7.09
Soft cast-iron (No. 8)	7.91
Steel alloy (soft)	8.25
Steel alloy (hard)	8.41
Medium cast-iron (No. 5)	9.00
Medium cast-iron (No. 6)	9.00
Hard cast-iron (No. 7)	9.36
High carbon steel (hardened)	19.56
Cobalt-chromium-molybdenum steel (cast)	127.90
Cobalt-chromium-molybdenum steel (rolled)	148.53
Cobalt-chromium-tungsten (No. 11)	334.35
Cobalt-chromium-tungsten (No. 12)	439.07
Cobalt-chromium-tungsten (No. 13)	449.75

Four tests in duplicate were also made on a sample of nitrided steel. The comparative wear values (K) for the successive tests were 33.61, 26.84, 21.24 and 14.50, which indicate decreasing resistance to abrasion as successive layers of the "case hardened" steel are removed.

Objection to Group Insurance

By W. F. Schaphorst

In view of the fact that most glass manufacturers are more or less interested in group insurance I am sure that many readers will welcome the following information which is the experience of one of my clients with this type of insurance:

While business was good with my client and all of his employees worked day after day, month after month, and year after year, the group insurance plan seemed to be all right. But the deplorable "depression" came along and as a result it was necessary to drop employees one by one so that finally very few workers were left. Under the circumstances it was both expensive and impracticable to continue to carry the insurance on employees who were not working for the concern. The employer found it impossible to keep in touch with his former employees many of whom were in other cities, working at other trades, and were not interested in keeping up payments on their insurance. Others who were not working could not make payments even if they wanted to. The only sensible thing to do, therefore, was to cancel the policy, and that is what my client did. Of course the insurance company was the gainer while my client and his employees were the losers. All money that they had put into the policy was lost to them because the policy did not have a cash surrender value at the time of cancellation. To be sure conditions of this kind may not be experienced in every instance, but the possibility of their repetition should be given consideration before going into any kind of insurance contract.

I believe in and carry insurance myself. There is a "right kind" for nearly every situation.

The Manufacture of Rolled Plate

By ERNST LUTZ *

This work has been revised, so far as the English and the technical expressions are concerned, by F. W. Preston, who has also added a number of notes relating in general to the special conditions of American practice; but it must be understood that the opinions expressed in the text are those of Mr. Lutz, and neither the Editor nor Dr. Preston accepts responsibility for them.

(*Continued from the May, 1931, issue*)

WHEN cooling down, the overheated rods in the lehr will distort, so that the roller u does not again meet the corresponding guide groove in the beam c; this roller will then run on the edges of the groove and the end of the corresponding rod in passing over the lift beam c, will protrude over the others. In some works the original rods of

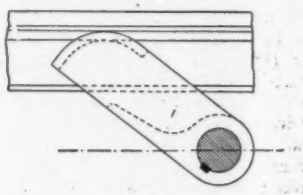


FIG. 119

the carriage were replaced at their front end by appreciably stronger sections, so that the danger of sagging in the interval u to u' was reduced. Bent rods h, for their realigning can be withdrawn through the fifth chamber to the front after disconnection from the traveling frame y. During this operation they must, however, not part from the head rollers v in the lehr runway. Even the lift rails d will sag if they get too warm. The castings of the lift beams c have the disadvantage, that under the influence of heat they distort upwards or downwards. The design shown in Figs. 120 and 121 avoids this drawback; in this case the iron rails are built up of a number of short pieces, so that they distort less. The lift supports e, which are designed as box girders, also warp more or less in the heat, thus disturbing the uniformity of the position of the rods d. By ventilating the interior of these box girders, the said disadvantage is somewhat counteracted; the ventilation is effected by dividing the box into an upper and a lower compartment, with a gap in the middle of the partition plate. The warm air leaves the two beam-ends from the upper compartment, and causes fresh cold air to be sucked through the lower openings of the two beam-ends. This circulation can be furthered by connecting the upper openings of the beam-ends with tubes which move up and down with the beams and induce a chimney-draft.

The first heating up of the lehr should be done very slowly and carefully, so that its bottom, which was aligned when cold, the lift, and the supports of the mechanism, are not affected. Above all care has to be taken that the brickwork of the runway floor does not rise; this danger is particularly acute if the heating from below is done too quickly and too strongly. In this respect the part of the brickwork over the beginning of the four lower fireplaces is most sensitive, particularly the one which forms the space, in which the second lift beam e moves up and down. For the protection of this brickwork each heating duct of the four lower fires is provided with an arch I (Fig. 111). The brickwork of the runway bottom should further be provided with sufficient clearances for expansion. The supports of the lehr mechanism must not rest on the arches covering the heating ducts of the four lower fires, but only on the partition wall of the said heating ducts, so that the expansion of the arches is without influence on the position of the mechanism.

In view of the extraordinary length of the lehr, special consideration must be given to its site and its foundations, in order that there may be no belated settling and that all parts shall keep their alignment. The whole brickwork has also to be carefully protected from any humidity rising from the ground.

As mentioned before, every 6 to 10 minutes the rough glass sheets are removed for somewhat more than one sheet width; as the length of most lehrs is so chosen that there is sufficient room for 26* rough glass sheets, of which five are in the chambers, one on the lift and twenty in the lehr channel following the lift room, the time taken between the insertion of the sheet in No. 1 oven and its removal on the roller trucks, is about 156 to 260 minutes, i.e., approximately 2½ to 4½ hours. The time of six minutes for the casting of the sheet is adhered to in exceptional cases only; for the cooling in the lehr 2½ hours are, however, sufficient. The speed of the work is evidently not limited by the time taken for annealing, but rather by the speed with which the rough glass sheets can be removed from one oven of the lehr to the next and also by the speed of casting and rolling, and finally by the time required to bring the pots to the casting table and back to the furnace. Under normal circumstances, every 7½ minutes a rough glass sheet will be inserted; this corresponds to an annealing time of 3½ hours and of two hours casting time for the 16 pots of one furnace.

The removing of one rough glass sheet from one oven to the next, if the sheet is removed lengthways, takes about ½ minute, and somewhat less when removed sideways. The stowing tools (see page 104)† are each driven by a motor of about 6 HP., which enables them to slide back with a

* Of Desseau, Germany. This work will appear in German in the forthcoming new edition of *Dralle-Keppeler*, "Die Glasfabrikation," due this year, about July. THE GLASS INDUSTRY probably will by early Fall have completed the English translation, with some comments on its applicability to American conditions by F. W. Preston.

FOOTNOTE: In the Figures, originally prepared for use eventually in the coming new edition in the German language of *Dralle-Keppeler*, "Die Glasfabrikation" in 1931, dimensions are given in metres (m) and millimetres (mm). We would like to have given these in feet and inches but the translation and the making of nearly two hundred and fifty new illustrations would have involved a prohibitive loss of time and expense. To some of our readers the metric system is as familiar as the English units; for the others we may say that a metre is approximately 40 inches, and a millimetre is approximately 1/25 of an inch. A thousand millimetres, of course, go to a metre.—*F. W. P.*

*There is some latitude available here, in American practice.—F. W. P.

† May 1931, issue.

velocity of up to 3′ per second. Each of the four runner wheels of the travelling frame has two flanges on which the wheels move. With the aid of a worm and worm wheel, the motor drives one shaft of the travelling frame; the two wheels of this driven shaft, are toothed in between their runner flanges and engage with the rack, forming part of the rails. The head of the tool which presses against the edge of the rough glass sheet, consists of an iron sheet 4′ in length, 8 to 10″ in width and ⅜″ thick. This iron sheet is fixed movably to the shovel handle, so that it is always in full contact with the bottom of the lehr and can follow each direction of the sheet edge. With its front edge, similarly to the action of the stowing tool of the casting table (Figs. 101 and 102), it grips the sheet edge in U-form; here again it is most important that the hollow of this U-form should be well lined with asbestos. The rear edge of the tool is curved upwards, so that when it is withdrawn the clay bottom of the lehr is not hurt. The pressure of this tool on the bottom of the lehr ovens should be as little as possible, i.e., tool and pushing rods must be of a light construction, so that the frequent to and fro movement of the tool causes but little wear of the bottom. To this end, the chamber bottom is covered with pulverized plaster or better, pulverized graphite.†

Of the lehr designs at present in use in Europe, the three sizes set forth in the following table are most frequently met. This table further gives the corresponding contents of the melting pots and the sizes of suitable casting tables.

Size No.	Capacity of the Melting Pots When Air Dried Cubic Feet	Casting Table, Inches	Clear Width of Lehr: Ovens, Inches	Clear Width of Lehr: Runway, Inches
I	22 to 24¾	315 x 177	295 x 177	299
II	26½ to 30	354 x 201	355 x 197	339
III	35 to 37	394 x 217	374 x 207	378

The introduction of the lehr into plate glass plants, in spite of constructional shortcomings which still exist, brought appreciable advantages over the single chamber annealing kilns. The main advantage gained was chiefly the fact, that the traveling casting tables became obsolete; their place was taken by a stationary table, which could be made more stable and was equipped with water-cooling. Further, more consideration could be given to the change over of rolls, their most effective design and cooling. The consequence thereof was an appreciably improved flatness of the sheets and further, on an average, the sheets could be rolled .040″ to .100″ thinner. This meant that, per sq. foot of plate glass, less batch material had to be melted and the costly work of grinding was reduced. For equal thicknesses of the finish-polished sheet, less rough glass had to be ground off than before.

A better flatness of the rough glass sheets was also obtained from the lehr than could be expected from the former annealing kilns. The bottom of the lehr can be kept much stronger than that of the single chamber oven, as it does not need to cool down along with the sheet, but rather must keep the proper temperature continuously; free from great temperature variations, the lehr bottom will also distort less. In the intervals between casting, the lehr is kept under fire, so as to maintain its heat and to have only small temperature variations in its different parts. During casting the fresh sheets inserted carry with them an appreciable quantity of heat, consequently less gas is required than in the intervals.

The more furnaces there are working for one lehr, i.e., the more rough glass sheets pass through it in succession, the cheaper and more economical is its working. On account of the said small temperature variations and also due to the favorable distribution of the burners in the lehr chambers, in contrast to the one-sided heating in the single chamber kilns, the temperature over the total space of the individual ovens is much more uniform; the rough glass sheets will, therefore, not distort appreciably or at any rate much less than formerly (see Fig. 109) and the cooling schedule is also more favorable.

In the fifth oven the glass should already be so rigid that when put on the lift and on the rods of the lehr mechanism, it should show no permanent distortions; from this moment onwards, and with a continuously operated lehr, the flatness of the rough glass sheet should no longer be questionable. From the lift onwards there is, however, still the possibility of breakage.

Experience has shown, however, that less breakage takes place in a lehr than in the single chamber annealing kilns; the more complete annealing of the glass in the lehr causes the cracks to branch out less and to be less ruinous than in the old annealing kilns; with the same surface of rough rolled sheets, the effective output in square feet of plate glass is, therefore, higher with lehrs than with single chamber kilns.

Again the fuel consumption of the lehr is appreciably less than that of the single chamber kilns. Per square foot of finished and cut plate glass the annealing kilns required about 15,000 heat units; the lehr on the other hand, if about 32 sheets are cast daily, requires 6,500 heat units, or 4,200 heat units per square foot, if 48 sheets are cast, i.e., the more sheets produced, the less the heat units per sq. ft. Assuming pit coal of about 7,500 heat units, evidently about 4.3 lbs. of coal were used for the annealing of 1 square foot of finished and cut plate glass, whilst today, and with two furnaces in commission, 2 lbs., and with three furnaces in commission, 1¼ lbs. of coal are required per square foot.*

Again, the floor space required by the lehr is appreciably smaller than that of the great number of single chamber kilns previously required.

Finally the saving in manpower is quite important. Based on eight hours' working time, the following table shows the men required in a rough glass factory equipped with single chamber kilns and also that of a shop operating with lehrs; in each case three furnaces each with 16 pots are assumed to be in commission. Further, a traveling crane with pot-removing apparatus as shown in Fig. 36, but of improved design requiring only one man for its operation, an automatic silo and a pot-filling machine. The various shifts are scheduled on the assumption that in the ordinary course the time taken for casting the 16 pots of one furnace is two hours, i.e., for three furnaces a casting time proper of six hours has to be considered. Added to this must be the work of preparation for the casting and also the work of

† Not in American practice.

* America's plants rarely cast less than 100 plates per day.—F. W. P.

cleaning up when the casting is finished. After the insertion of the last rough glass sheet some of the men have also to serve at the lehr chambers until the last sheet is placed on the lift; finally a few men are required for odd work at the furnaces and also for general cleaning up, so that the whole shift is altogether fully engaged for eight hours.

During the casting of the 48 pots, stoppages ought to be avoided, as they influence the temperature conditions and spoil the good and continuous run of the lehr. The work on the furnaces has therefore to be so scheduled, that after the casting of the last pot of one furnace, that of the first pot of the next furnace is carried on at once. The withdrawal of the rough glass sheets from the lehr also takes about 6 hours. The gang occupied with the stowing, inspection, cutting, sorting and the transport or putting in stock of the rough glass, including additional odd work, is therefore also fully engaged for eight hours.

OPERATION OF THE LEHR

The reduction of labor caused by the introduction of the lehr is evidently remarkable. For the following table it is assumed that the rough glass factory with single chamber annealing kilns is also equipped with pot-removing machines, conveying the full pots to the casting crane and the other way 'round fetching the empty ones. Actually the former casting and annealing shops in a few instances only were so laid out, that later on the more modern pot-removing machines could be fitted in in such a favorable way. Almost exclusively the melting pots were withdrawn and inserted with the aid of hand tongs and conveyed into the range of the casting crane with hand trucks (see Figs. 28 to 33); this required 4 to 6 men more than stated below, their total number becoming 160 instead of 156. It is further assumed that in both cases a travelling crane runs over the cutting tables and the rough plate glass store, and is able to grip the large sheets with tongs; this equipment again was actually only introduced together with the lehr. Formerly the large rough glass sheets were carried by a special gang to the rough glass store and to the grinding shop, again requiring 6 to 8 men.

The maintenance of the rough glass store mentioned under XI of the above table, formerly meant appreciably more work than today because the old way of manufacturing produced a larger number of imperfect sheets than the lehr method. Formerly it was necessary to sort out all uneven sheets in order to grind them together with special precautions: if warped sheets and flat sheets had been put on the grinding table at random, it would have been necessary to grind them all slowly; further, the variations in thickness were appreciably greater than with lehr glass, so that sorting had also to be done in respect of thickness, and sheets of about equal thickness had to be worked together. Today this precautionary measure is no longer necessary.

The work of the lehr attendant begins after the fifth sheet has been cast, and when he has worked for eight hours there are usually only five to ten sheets left in the lehr. Special arrangements with the foreman at the other end of the lehr are therefore not required, and the lehr attendant may be relieved by one of the men mentioned under X, whose shift only began with the exit of the first sheet from the lehr, i.e., after the casting of the 26th sheet. The supervision at the

	Working with 3 Furnaces and	
	Single Chamber Kilns, Number of People Employed Per 24 Hours	Lehrs, Number of People Employed Per 24 Hours
I		
Worksmanager	1	1
Foreman	1	1
Assistant foreman	1	1
II		
AT THE MELTING FURNACES:		
Foremen	2	2
Melters and refiners	9	9
Jobbers and pot filling apparatus	11	11
III		
POT-ARCHES:		
Stoker	3	3
IV		
BATCH MATERIAL—CHAMBERS:		
Batch-maker	2	2
Jobbers	2	2
V		
GAS PRODUCTION		
Foremen	3	3
Stoker	9	12
VI		
BRICKLAYERS:		
Foreman	1	1
Bricklayers	5	4
Jobbers	4	3
VII		
CASTING:		
Staff for serving pot-removing crane	1	1
Foreman	1	1
Casting force	7	4
Shutting and sealing of the annealing ovens	2	..
VIII		
ANNEALING SECTION:		
Lehrdriver	..	1
Lehrstoker	..	3
Stoker-foreman	1	..
Stoker	12	..
Ventilation of annealing ovens	4	..
Maintenance and dressing of annealing oven bottoms	15	..
Supply of combustibles and removal of ash and soot	8	..
IX		
SUPERVISICN OF MECHANICAL AND ELECTRICAL APPARATUS: (Exclusive of workmen in the general repair shop):		
Fitter	2	2
Electricians	1	1
X		
FURTHER TREATMENT OF THE ANNEALED ROUGH GLASS SHEETS:		
Foreman	1	1
Withdrawal of sheets from the annealing ovens and transport to the cutting tables	4	2
Inspection, sorting, cuttings	6	4
Rough sheet porters	6	5
Crane driver	1	1
Clerk	1	1
Odd jobs, cleaning, collecting of cullet	1	1
XI		
ROUGH GLASS STORE:		
Supervision and handling out of rough sheets to the grinding shop or the dispatch department	6	3
XII		
General cleaning and messenger service	2	2
Total	136	88

head of the lehr and keeping in contact with the lehr attendant is one of the duties of the casting foreman mentioned under VII. In larger glass factories a special man is required for this job.

The gang of men unloading the coal and the batch materials, as well as for the removal of dirt, and, the workmen for repairs, the mechanics, pot- and refractories-makers are not mentioned in the above comparison. They are considered later in another table. The men required 'round the furnaces during the casting for assisting in the removing of pots, mending the bottoms, sealing the doors, and the like, are counted under II.

If four furnaces, with altogether 64 pots, are in commission, the casting will take about eight hours.

In this case it is best to conclude an arrangement with the casting-hall and cutting-table men for piece work or bonus, to the effect that they take over the whole casting, including the preparation and clearing work, the withdrawal, sorting, cutting and transport of all 64 sheets, no matter whether they require more or less than eight hours, inclusive of interruptions of the work. Such an arrangement should of course only be made on condition, that the quality of the work does not suffer. If it is impossible to make such a stipulation the extra hours have to be paid for separately or a flying gang has to be formed, which assists at the various operations either at their beginning or at their end, so as to cover the time over and above the eight hours; under certain circumstances the workmen preparing the batch and the fire-bricks can be trained for this purpose. However, for the sake of quality and the smooth run of work, this last named proposition is least advisable.

If five furnaces are in commission, a third gang is required in any case, to take over the casting of the first 25 sheets and the withdrawal and cutting of the first 30 sheets. The ordinary casting gang and the ordinary cutting table shift have only to manage with the main part of the work, which takes them just about eight hours. In a rough glass factory with a lehr and four furnaces in commission there are thus about 105, and in one with five furnaces about 130 men required, in place of 88 for three furnaces as shown in the above schedule; with six furnaces about 145 men are required, and so on. The number and subdivision of the men in the first instance naturally depends on the craftsmanship and the capacity of work of the people at disposal; as this is quite a special high grade work, the type of workman and his training plays an important part. Depending entirely on the working capacity of the men available, the one or the other subdivision and arrangement with a certain number of furnaces in commission will be the most economical.

It may be figured that one lehr is required for 9 furnaces, which is then continually filled with sheets; however, for large factories it is advisable to keep a second lehr in reserve. Depending on the time of service, the lehr has to be completely cooled down every one or two years for one or two weeks, so that it can be overhauled, i.e., its interior be inspected, repaired and re-aligned. For instance, it takes about two days until the lift has cooled sufficiently so that the craftsmen can work therein at intervals; the ovens can only be entered later. For the re-heating, one or two weeks suffice. By this interruption of the work, the whole run of the glass factory is stopped for about two to four weeks and the average cost per square foot of rough glass produced is appreciably affected by it; during these days part of the workmen can be given leave or be engaged with work which has to be done in any event and has been kept back for this time. The time of shutting down of the lehr is of course made to coincide with the change of melting furnaces. The remaining furnaces, however, must be kept under fire. For this period there must also be enough rough glass in stock to keep the grinding shop busy. At ordinary times about a full month's output is kept in stock. This is not only done for the sake of continuity, but also to have the necessary choice of various sizes; in anticipation of such shutting down, however, double this quantity has to be stored up.[1]

It is some drawback to the lehr, that extra thick sheets cannot be annealed without special arrangement. As stated on various occasions, the lehr works the better, the more continuously it is charged, i.e., the less the temperature variations that occur in its interior, the more uniformly does its temperature decline and the more regular are the intervals between the advancing of the sheets. Now thicker sheets will cool more slowly than those of ordinary thickness (3/8 to 7/16"); they have to stay longer in the various ovens for attaining the required rigidity for removal on to the lift. In the runway too, they must not advance too quickly, as otherwise they may break. It is *possible* to anneal sheets of up to 3/4" together with those of ordinary thickness; but, it is advisable to cast them last. If time permits, all sheets within the lehr can, in such a case, be left lying longer; as long as no thick sheet has arrived at the lift, they can be left longer in the ovens than ordinary sheets. In this way it is possible to anneal in the normal run sheets up to 7/8" thickness. Most glass plants, however, for the production of thick sheets, still keep some separate single chamber annealing kilns of old design and with separate travelling casting table.*

[1]As mentioned above, it is not always easy to install the lehr as described here with the zigzag arrangement of ovens, in an existing factory. Moreover, the shifting of the plates through the ovens is an intricate business and the stowing mechanisms occupy a great deal of space. Again, the distribution of temperature over an oven and from oven to oven is apt to fluctuate somewhat. Experience has shown that the wearing of the oven floors by the plates and still more by the stowing tools, and the continual interruption of the work for repairs, cause a lot of trouble. Therefore the desire soon arose to avoid the zigzag arrangement of the ovens and to make the whole lehr one *straight track throughout*. Success was achieved in constructing devices that allow of this arrangement, and they have proven entirely satisfactory.

These shifting devices, however, are not very simple ones, and the wear of the lehr stones in the front end of the lehr still remains unavoidable, though it is less troublesome than before. Interest, therefore, turned next to *annealing lehrs with conveying rollers*, which had already made good in the manufacture of other kinds of flat glass, and they were successfully adapted to the manufacture of rolled plate—so successfully in that a faultless evenness of the plates is obtained.

Further information will be found later in the sub-chapter, "Experiments and new methods of manufacturing thin rolled plate and glass of normal thickness."

*In America this work is mostly segregated in separate factories.—F. W. P.

Feldspar Standards

Copies of the U. S. Department of Commerce, Bureau of Standards, Commercial Standard CS23-30 for Feldspar, issued October 22, 1930, are available from the Superintendent of Documents, Government Printing Office, Washington, D. C. This standard was adopted on January 14, 1930, at a general conference of manufacturers, distributers, and users. Certain adjustments in the proposed standards which were referred to a committee with authority, were then made and the standard has since been accepted and approved by the industry. It became effective for new production September 1, 1930.

Glass Industry

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The End of the Glass Industry

ON another page we present an account of the progress made by the General Electric Company in producing a 200-inch disc of fused silica. Somewhat similar accounts are appearing in many other journals, and popular interest in the development is such that the General Electric may perhaps be pardoned for bowing to the public at some length at the end of the first act.

The 200-inch mirror has not yet been produced, but only mirrors much smaller than the largest glass disc now in use. There is, however, no reason to doubt that the larger silica discs will be made, and made successfully; it is most probable also that when made they will be better than glass discs, but this remains to some extent a point to be decided by long experience.

Fused silica is of course a glass in the scientific sense, but it is not produced by methods having much in common with the glass industry's regular practice. There is very little that glass can do that fused silica cannot do better, and we may do well to ask ourselves whether fused silica will not ultimately replace glass almost entirely.

White sand is nearly pure silica in many cases; it is the cheapest of the materials we use in glass making, and forms about three-quarters of the weight of a typical window or bottle glass. We should be glad to use four quarters instead of three, on the score of economy alone, were it not that the temperature needed to melt the stuff in the absence of fluxes (soda) is too high for us with our present methods.

Apart from economy in raw materials, the product is better. Window panes of fused quartz will transmit the ultraviolet better than any glass; chemical beakers can be made red hot and dropped into water, being three times as good as Pyrex and nine or ten times as good as ordinary glass in this respect. With such a material the bottle manufacturer need not worry about his bottles failing to pass the hot water test. Moreover, fused silica is more durable on exposure to the air and to other chemicals.

Putting it another way, the soda and lime that we now use in our glasses must be regarded as impurities. Deliberate impurities, of course, like the traditional dog meat in the pork sausage, and like it, used solely to facilitate the work of the manufacturer, though of no special value to the consumer.

If there were no difficulty in getting temperatures a few hundred degrees hotter than at present, we should never use soda and lime in our regular glassware. We should use nothing but sand. And most of our troubles would be over.

It is not yet possible to say what meaning the developments of the General Electric Company have for the industry. The present process, as described in the article mentioned, is cumbersome and costly, but it probably represents only the beginning of a series of developments which will not cease till fused quartz has completely replaced glass, and the only soda and lime in a glass bottle is soda and lime water.—F. W. P.

Reference to the contents of earlier issues of THE GLASS INDUSTRY can be found in the Industrial Arts Index in many Public and Technical Libraries.

On Nostrums in Glass Manufacture

THE practices of charlatans have followed many directions although they perhaps are most known in connection with the treatment of disease. So it is natural that glass manufacture in former times should have been the prey of such quacks. Glass-making used to be a process that seemed particularly susceptible to disease. Like the human body it appeared to be affected by draughts, cold winds, dampness and the phases of the moon. The patent-medicine method of treatment of glass diseases was a logical development.

Many a "clarifier" has been put forth as a panacea for all ailments of the glass. No small amount of So-and-So's "brightener" has been purchased by this plant or that on the assurance that it would make the glass less brittle, permit the use of higher percentages of cullet, form seed-free glass with less consumption of coal, bring about a more lustrous product, and, indeed, help make the life of the glassmaker a virtual bed of roses.

Some of these nostrums, nevertheless, did accomplish something besides lightening the pocket-book of the factory owners. Some of them helped to remove seed, and some did help decolorize the glass. Perhaps on this account they should not be condemned. The man who disguises salt-cake with a bit of barytes or gypsum and sells it for five times its value may be conferring a favor upon the glassmaker if by this fact the glassmaker is able to obtain a less seedy glass. By the same token one might justify the sale at exhorbitant prices of an arsenic-lime mixture labeled with a fancy name and put forth as a mysterious brightener.

One might think that such practices would not be encountered in this age of enlightment. Nevertheless each year seems to bring forth one or more of these nostrums, generally the discovery of some zealot in that poorly defined place known as "the old country."

It is strange that the very people who are most susceptible to the wiles of those who live by their wits are least ready to listen to the advice of scientists. The money spent on nostrums in many a plant would have paid the salary of a competent chemist.

The moral can easily be found by a study of the progress made by different glass factories. Every such plant that has achieved unusual success will be found to have had competent scientific advice.—D. E. S.

Morey and Bowen Name Soda-Lime-Silica Compound

To the Editor of THE GLASS INDUSTRY:

"DEVITRITE"

Sir:

We have read with interest various letters, including those from you, concerning the assigning of a name to the compound, $Na_2O.3CaO.6SiO_2$. There is of course no reason or excuse for naming the numerous silicate compounds made in the laboratory, which have no counterpart in nature, and when this compound was discovered[1] we saw no reason for making it an exception. Nevertheless, we agree that the importance of this compound in connection with any discussion of either the composition or the devitrification of glass makes desirable a name, if for no other reason than the awkwardness of repeatedly reciting the formula of the compound. A name for a compound should if possible carry an impression as to some outstanding property or characteristic; and the outstanding characteristic of the compound, $Na_2O.3CaO.6SiO_2$, is its appearance as the primary phase in the devitrification of a large proportion of the glasses of commerce. It seems to us, therefore, that the name, "Devitrite," carries with it this idea and, accordingly, would be a suitable name for this compound. We propose to use it in the future.

(Signed) G. W. MOREY.
N. L. BOWEN.

Geophysical Laboratory,
Carnegie Institution of Washington,
May 5, 1931.

[1] G. W. Morey and N. L. Bowen, J. Soc. Glass Tech., 9, 226, 1925.

The above letter meets a need that many of us have felt for a long time, and the editors of THE GLASS INDUSTRY are more than pleased to act as god-fathers at the christening of this hitherto nameless offspring of Messrs. Morey and Bowen.—*F. W. Preston.*

Remarkable Achievement by British Optical Glass Manufacturers

We have received a copy of a memorandum from Chance Brothers and Co., Limited, Birmingham, England, the well-known manufacturers of optical glass, which gives the results of recent research into the development of types of borosilicate glass for the manufacture of prisms in which the light absorption has been reduced to a remarkable extent. Determinations by an improved method using monochromatic radiation from a mercury arc lamp have been made for this company by an outside and independent authority, and the values for the coefficients of absorption per centimetre of glass are given below for the ultra-violet and visible parts of the spectrum.

GLASSES MADE BY CHANCE BROTHERS AND CO., LIMITED

BOROSILICATE CROWNS, index 1.51 V 64. (approx.)

Monochromatic Wavelength of Radiation used		*Percentage of light absorbed per cm. of glass*				
		λ=3650.3	λ=4078	λ=4358	λ=5460.7	λ=5790.5
Glasses examined	*Date made*					
B. S. C. 5509	1923....	3.49	0.98	1.23	0.72	0.81
B. S. C. 5889	1929....	1.65	0.67	0.87	0.41	0.51
B. S. C. 5990	1930....	1.44	0.55	0.76	0.44	0.51
B. S. C. 5993	1930....	1.35	0.51	0.81	0.45	0.51
Borosilicate (best obtained) from other manufacturers No. 22771	1929....	2.37	1.14	1.28	0.74	0.69

The values given in the table may require a slight modification when all the corrections to be applied to the results obtained with this apparatus have been explored. Such modification will not affect the relative magnitudes of the absorption coefficients given. It is also intended to determine the coefficients of absorption for light of longer wavelengths than those given above.

It will be observed that the earlier British glass 5509 was inferior in the near ultra-violet region and in the yellow to the best glass obtainable from other sources. Later British glasses are superior to this glass, the superiority being marked in the two latest British products 5990 and 5993. These glasses are, in fact, the most transparent of all the glasses which have been examined, efforts having been made to obtain the best specimens of glass from other sources in order that the comparison may be as fair as possible.

The Annual of Ceramics and Glass for France. *Annuaire des Ceramistes et Verriers de France,* 1931, published by J. Hogrel 12 Rue des Petites Ecuries, Paris (X°). The 1931 edition, a volume of over 500 pages, 5 by 8¾ inches, contains names and addresses of manufacturers of all kinds of French glass and ceramic products, also dealers, agents, importers, exporters, and data concerning glass and ceramic associations, syndicates, experts, trade marks, etc. The work is divided into five main sections all carefully edited, classified and brought up to date. It is a most valuable publication for anyone desiring to locate concerns identified with the glass and ceramic trades in France.

Mr. Monro at Washington Tariff Hearing

REASONS why the United States Tariff Commission should and why it should not recommend to the President a reduction in the present tariff rates on cylinder, crown and sheet glass were placed before it at a hearing held in Washington, May 15. The hearing was the result of a resolution by Senator Royal S. Copeland, of New York, adopted at the last session of Congress, calling on the commission to investigate the differences in manufacturing costs as between American and European manufacturers of glass.

Only one witness appeared for the American manufacturers—William L. Monro, of Pittsburgh, president of the American Window Glass Company, and of the Window Glass Manufacturers Association of the United States.

Mr. Monro was careful to tell the commission that the absence of other witnesses should not be taken as an indication of lack of interest by American manufacturers in the possibility of a tariff change. On the contrary, he said, he had received offers from many manufacturers who were willing to appear as witnesses, but in view of the commission's familiarity with the glass industry he did not believe their presence necessary.

Louis Titus, of Washington and John R. Rafter and Mario Mazzarovich, of New York, appeared for the Union des Verreries Mecaniques Belges, Charleroi, Belgium, the Sales Corporation of Bohemia Sheet Glass Factories, Prague, and the Vitrea Company, Inc., New York.

Mr. Titus opened the hearing by outlining the steady decrease in imports of glass into the United States during the last decade. Most of the glass brought into the United States from abroad at present is photo glass and other higher grades, he said, the movement of low grade glass having virtually stopped.

He said the troubles of American manufacturers were due to cutthroat competition among themselves rather than foreign competition. The small producer of glass is being slowly forced out of business.

"At the present time," Mr. Titus said, "freight rates prevent foreign glass from being sold in Chicago and other interior markets. Some foreign competition, however, is necessary.

"The people in the interior are just as much American citizens as those on the sea coasts, and they are entitled to the benefit of foreign competition. In determining the differences in costs between American and foreign competitors, the commission must not overlook the vast number of people living in the interior."

Taking the stand as the first witness, Mr. Mazzarovich presented figures showing that imports of glass into the United States in 1930 were lower than in any year since 1910. "From 1929 to 1930," he said, "imports of ordinary window glass from Belgium have decreased about 90 per cent.

"The present duty on ordinary window glass is equal to about 650 per cent of its value f.o.b. European ports," he said, "and the present duty on heavy drawn sheet glass equals about 836 per cent of the value of such glass.

"To market their glass in America at the present time, therefore, the Czechoslovakians would not only have to give away their product, but would have to pay a cash bonus in addition."

The witness also presented the commission with tables showing the decline in glass prices during the past few years. He emphasized this decrease had occurred notwithstanding the concurrent decrease in imports. "At present prices," he said, "ordinary window glass could not be imported into the United States even if there were no tariff duty at all."

"Do you believe the tariff has lowered the prices of glass in the United States?" inquired Chairman Henry P. Fletcher.

"No, I don't say that, but the fact remains that prices have declined despite the tariff," the witness replied.

Taking up the question of how the commission should go about determining the differences in the cost of production as between American and European factories, Mr. Mazzarovich reiterated testimony he had given before the commission during its 1928 hearing, when the same subject was under investigation.

"The commission," he said, "should make production cost comparisons for sheet drawing processes only, since the machine cylinder process is now obsolete. No consideration should be given to machine cylinder or hand cylinder glass. The inclusion of cylinder processes in the commission's cost comparison would give a picture which in no way represents the actual conditions of the industry."

Mr. Mazzarovich suggested the commission establish a rate of depreciation which would be the average between the Belgian, Czechoslovakian and American rates and that this rate would be applied to establish the depreciation figures for both domestic and foreign glass.

He said it also would be fair if such average depreciation rates could be established for the various groups of assets; for instance: one rate for factory machinery and equipment, another for buildings, another for office equipment, and so on.

Mr. Monro warned the commission that its investigators should not only go over the books of the various manufacturing plants where they were seeking the costs, but that they should take into consideration various differences in operating methods and machinery. He covered at some length the development of the glass industry, particularly of the Fourcault machine.

"The commission should not concern itself with the decline in imports in recent years," he said. "It should only be concerned with the difference in production costs. I don't believe any mandate of Congress should be used to help along a foreign industry. The foreigners have had the cream off the American market for a long time."

He pointed out that production capacity was greatly in excess of consumption, saying that was the real difficulty.

Mr. Monro said American manufacturers are selling glass below the cost of production at present. He deplored the "internecine warfare" which, he said, was being carried on

in the American glass industry, as well as in other American industries.

Despite the extremely low prices obtained for the finished product, Mr. Monro said there has been little change in manufacturing costs. He said his own plant had no decrease in operating cost during the three years ended September, 1930.

Mr. Rafter, in cross examining Mr. Monro, attempted to show that during the commission's 1928 hearing Mr. Monro had testified that wages had been reduced in his plant. Mr. Monro admitted this testimony, but said he referred to wages paid to labor on the cylinder process.

Wages paid to Fourcault machine workers not only had not been reduced, but actually had been increased, he said.

"It was only through the stupidity of the manufacturers that we had to increase the wages of our cutters from 52 cents to 56 cents per box last October," he said.

Mr. Monro said the commission should not count as part of the foreign manufacturers' costs the freight rates on glass from the seaboard to the interior. In many cases, he said, foreign manufacturers at present can lay down their products at the American seaboard for less than the American manufacturers can, and they should not be given the additional advantage of being permitted to ship to the interior.

He concluded by deploring the tariff making methods of Congress, but declared he was willing to trust the commission to do a good job. He said he looked on the commission as "a sort of white man's hope."

Semet-Solvay Acquires Koller Gas Producer Patents

The Semet-Solvay Engineering Corporation of New York has acquired patents and manufacturing rights relating to the Koller gas producer and the Koller mechanical grate, together with the industrial gas equipment formerly manufactured and sold by the Gas Research Company and the Smith Gas Engineering Company of Dayton, Ohio. Both of these lines will be further developed, with the present Semet-Solvay Engineering gas and coke plant equipment.

The American patent rights to the Koller gas producer developed by Carl Koller of Budapest to meet the problem of adequate gas yield when using inferior qualities of fuel were acquired by the Gas Research Company and designs developed to meet American industrial conditions. The producer is said to have been installed by glassmaking, as well as coke oven, chemical, ceramic, steel and automobile plants.

Pennsylvania's Old Glasshouse Days

Details relating to the business of glass manufacture over 80 years ago at the Iron City Glass Works, Elizabeth, Pa., are disclosed by papers in the possession of Mrs. J. H. Christy of that city, which were retained after the death of her father, Robert Smith, who owned the Iron City Glass Works and a general store in town catering to the glass blowers and to boarding houses. It is thought that the publication of these simple activities may be of interest, especially to some of the old time glass workers still living in or hailing from that section of Pennsylvania.

Included among the other papers which have become yellow with age and are in such a condition that facsimile reproduction by photography and engraving is impracticable, is a quaint-looking list of "prices current" for glass issued by Lorenz & Hamilton, proprietors of the glass plant. Lorenz was the brother-in-law of Mrs. Christy and Hamilton a friend of the family.

The price sheet is surrounded by an ornamental border and the heading is printed in antique decorative type, by Johnston and Stockton, Pittsburgh.

It quoted prices on window glass in boxes of 100 feet (300 lights) 6 by 8 inches as $1.75; 10 by 14 lights, 102 of which made a boxful were quoted at $6.00 per box; 12 by 14 size with 86 lights per box cost $8.00. A box containing 20 sheets, 24 by 30 inches in size was quoted at $15.00. Numerous intermediate sizes were quoted, proportionately. Double strength and coach glass, large sizes made to order cost $15.00 per box. Circular glass made for "shew" windows were $0.62½ to $1.00 per light.

Imitation crown glass was made to order at from $12.00 to $18.00 per box. Under the price list the claim was made that the above glass was manufactured from the very best materials and was "equal if not superior to any cylinder glass made in the Western country."

Among the material preserved was a letter from Joseph Hendrikson, Addison, Somerset County, Pa., dated April 2, 1848, and addressed to Mr. Robert Smith, which indicates that the parsons in those days though not parsimonious, were privileged persons and expected a discount from dealers on their purchases.

The letter addressed to Mr. Robt. Smith, reads:

> "Sir:
> "Please send me 150 feet glass 10 x 12, or 3 half boxes, also 50 feet or half box 11 x 16. Send me a bill. Send the glass care of W. Clark, Brownsville. Please send the 10 x 12 as low as possible, as it is for a parsonage in your (Addison) county. The funds will be forthcoming in 60 days or thereabouts.
>
> "Yours,
> "JOSEPH HENDRIKSON."

An invoice issued by the Pittsburgh store of Tassey & Best, commission merchants, etc., dated September 12, 1848, shows that the concern shipped on board the steamboat "Arrow" to Robert Smith, Elizabeth, Pa., one barrel of molasses at $5.00, one barrel sugar $2.40, half box of tobacco $.62, total $8.02. Another invoice dated January 26, 1850, shows that coffee, molasses, candies, rosin soap, corn brooms and four bars of iron were all ordered at the same time from the Pittsburgh house. Also one cask of soda ash, 1556 gross weight less 116 tare, 1440 pounds at 4¼ cents a pound, total $61.20.

Agree on Foreign Use of Owens Improvements

International litigation of widespread interest especially in the bottle manufacturing branch of the industry, involving the Owens-Illinois Glass Company and other defendents and started by the Europaischer Verband der Flaschenfabriken in 1926 has been settled by an agreement for the entry of a consent degree in the United States Circuit Court of Appeals. Involved in addition to the Owens-Illinois Glass Company were the Toledo Glass Company, Libbey-Owens Sheet Glass Company, The Owens European Bottle Machine Company and the estates of Edward D. Libbey and Michael J. Owens. The action grew out of a contract under which a syndicate representing bottle manufacturers in several European countries acquired the right to use the then newly invented Owens bottle machine. The suit was brought up for the purpose of determining the right to use further improvements which have been, and might in the future be developed in this device. Under the settlement agreement the three defendent companies named above accord the right to use in Europe, including Great Britain and Ireland, certain of their inventions for the manufacture of bottles.

Improvements in Corundite Plant

One of the developments undertaken during 1930 by the Corundite Refractories, Inc., with plants at Massillon and Zoar, O., in line with their policy of giving their customers prompt deliveries, was a new continuous tunnel kiln installed at the plant of the Imperial Brick Company at Zoar, O., which had been acquired by Corundite Refractories to be used as a new production unit.

This new kiln is 225 feet long and was designed by the engineering concern, Robertson & Company, Cleveland, O. It was built by the H. L. Dixon Company, Pittsburgh, Pa.

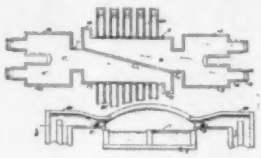
The building housing the kiln was constructed by M. E. Lutz, general contractor, Canton, O. Modern in every respect the new tunnel kiln will take care of the entire production of miscellaneous shapes and sizes of special refractories and super-refractories produced at the Massillon plant.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C., Price 10c each

GLASS-MELTING FURNACE. U. S. 1,795,933. Mar. 10, 1931. Samuel C. Cripe, Toledo, O., assignor to Libbey-Owens-Ford Glass Company. Filed 9/17/26. In sheet glass apparatus, a furnace including a tank adapted to contain a mass of molten glass, means whereby sheets of glass may be simultaneously drawn from the opposite ends of said furnace and means arranged within and spaced from the opposite sides of said tank for directing the molten glass towards the opposite ends thereof.



PROTECTIVE GLASS WITH COLOR WEDGE FOR SPECTACLES TOGETHER WITH METHODS FOR MANUFACTURING SAME. U. S. 1,805,969. May 19, 1931. Carl Gustaf Bostrom, Stockholm, Sweden. Filed 8/28/28. An article of manufacture, comprising a pair of glass plates secured together by a colorless cement compound of uniform thickness and possessing approximately the same transparency and refractory index as the glass plates, and a color wedge embedded in said compound, said color wedge being comparatively dense at one end and gradually fading into transparency toward its opposite end.

GLASS EDGING MACHINE. U. S. 1,804,263. May 5, 1931. Collis S. Mayflower, Flagstaff, Ariz. Filed 4/26/26.

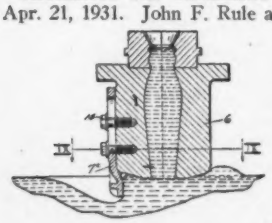
METHOD OF MAKING GLASS WOOL SHEETS. U. S. 1,804,254. May 5, 1931. Paul O. E. Friedrich, Millville, N. J., assignor to Gould Storage Battery Corporation, Depew, N. Y. Filed 1/25/27.

APPARATUS FOR MELTING GLASS AND SIMILAR SUBSTANCES. Reissue. U. S. 18,071. May 19, 1931. Harry F. Hitner, Oakmont, Pa., assignor to Pittsburgh Plate Glass Company. Filed 2/4/29. A tank for melting glass and similar substances, wherein the substance acts as a resistor, comprising a metal electrode constituting one of the walls of the tank, and having an opening therethrough for the discharge of melted material, a second electrode at a point remote from the said first electrode positioned so as to transmit current through the material in the tank at said point, and means for supplying electric current to the electrodes.

GLASS SHEET DRAWING APPARATUS. U. S. 1,805,329. May 12, 1931. Paul Escole, Jeumont, France, assignor to Ateliers de Construction & Founderies de Jeumont, Jeumont, France. Filed 12/12/28 and in France 5/5/28.

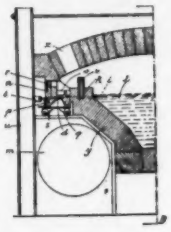
BOTTLE-SILVERING MACHINE. U. S. 1,804,484. May 12, 1931. Miner P. Wetmore, Norwich, Conn., assignor to The American Thermos Bottle Company, Norwich, Conn. Filed 7/30/27.

APPARATUS FOR GATHERING MOLTEN GLASS. U. S. 1,801,457. Apr. 21, 1931. John F. Rule and Leonard D. Soubier, Toledo, O., assignors to Owens-Illinois Glass Company, Toledo, O. Filed 5/15/28. In a glass forming machine, the combination of a mold for gathering glass by suction, and an implement attached to the mold in position to project downwardly below the bottom of the mold behind the mold cavity.



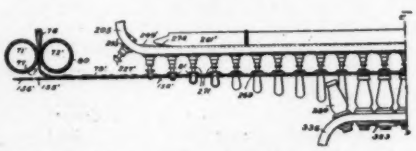
GLASS BAR. U. S. 1,797,855. March 24, 1931. Edward James Conlan, Brooklyn, N. Y., assignor to Kimble Glass Company, Vineland, N. J. Filed 5/19/30. The method of making a composite glass-bar, comprising fitting a glass-rod inside of an encasing glass-tube, and filling the space between said rod and tube by causing a liquid cement to flow into and to fill such space.

MEANS FOR MAKING SPUN GLASS. U. S. 1,796,571. March 17, 1931. Louis Mathieu, Paris, France. Filed 9/4/29, and in France 9/12/28. In a glass furnace, the combination of a glass tank having a side wall with a removable upper portion, said wall portion comprising refractory blocks separated by a gap, a perforated plate of heat-resisting material removably fitted in said gap and a brickwork filling, a metal carriage supporting said wall portion, means for holding said carriage in position, a partition projecting inwardly from said side wall for separating the glass in said tank from said perforated plate, a passage for the glass extending through said partition, means for controlling said passage, and means for drawing glass from said furnace through said perforated plate.



METHOD OF MAKING IMITATION LEADED GLASS. U. S. 1,800,763. Apr. 14, 1931. Kalman Warga, N. Y., assignor to Warga Industries, Inc., N. Y. Filed 4/5/28. The method of making imitation leaded glass which consists in first printing on a glass surface plane lines in imitation of the leaden strips of a leaded glass object, the chief ingredient of said lines consisting of a powdered silicious substance mixed with a liquid binder and flux, then coloring the various areas of the surface intermediate said lines by successive stencil transfers, said lines and said colors each containing a mineral pigment and a vitreous binding material combined to fuse at the same temperature, and then heating said glass to irremovably fix said lines and colors to the surface of the glass at substantially the same temperature.

GLASS WORKING MACHINE. U. S. 1,790,397. Jan. 27, 1931. William J. Woods and David E. Gray, Corning, N. Y., assignors to Corning Glass Works, Corning, New York. Filed 4/13/27. The hereinbefore described process of making blown glass articles which comprises forming a ribbon of glass from a parent body and progressively and sequentially blowing articles from the glass of the ribbon as it moves away from its point of origin.



In a glass forming machine the combination of a moving ribbon conveyor having orifices therein, of a stripper adjacent to the conveyor and rotating in a plane inclined to the face of the conveyor.

GLASS SURFACING APPARATUS. U. S. 1,801,314. Apr. 21, 1931. John E. Landolt, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 6/25/27. Means comprising a main conduit containing a polishing medium, an inclined header, means connecting the main conduit and header, a valve in said connecting means for controlling the supply of polishing medium to the sheet of glass to be surfaced, a plurality of pipes connected to the header and inclining upwardly away therefrom, and a valve controlled drain pipe connected to the lower end of said header adapted to drain the plurality of pipes and the inclined header when the valve in said main conduit and header connecting means is closed.

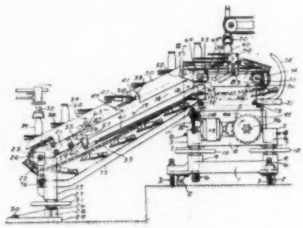
METHOD AND APPARATUS FOR FEEDING MOLTEN GLASS. U. S. 1,805,987. May 19, 1931. John R. Keller, Carnegie, Pa., assignor to Hartford-Empire Company, Hartford, Conn. Filed 3/7/22. The method of producing mold charges of molten glass that comprises applying a variable centrifugal force to a descending body of glass to vary the rate of descent of different portions of said body of glass.

METHOD AND APPARATUS FOR USE IN THE MANUFACTURE OF GLASSWARE. U. S. 1,806,445. May 19, 1931. Leon Jean Broche, Verrieres-le-Buisson, France, assignor to Tropenas Company, New York. Filed 12/27/28. In the manufacture of glass products, the step of severing a continuous product into lengths, which comprises advancing the material while hot upon a movable support and bringing a defined chilled area of said support intermittently into contact with the product to fracture the latter.

MANUFACTURE OF REENFORCED GLASS. U. S. 1,804,395. May 12, 1931. Walter J. Blenko, Pittsburgh, Pa., assignor to Clarence P. Byrnes, Sewickley, Pa. Filed 7/3/29. Apparatus for making reenforced glass comprising a bath of molten glass, a guide extending upwardly through the bath and adapted for the feeding of a reinforcing material therethrough, the guide terminating below the surface of the glass whereby as the reinforcement rises upwardly glass adheres thereto and forms a meniscus, means for drawing the formed glass upwardly, shaping dies having initial sliding contact with the meniscus, and means for cooling the dies.

WINDSHIELD FOR LEHRS. U. S. 1,803,032. Apr. 28, 1931, Claude Nagle, Elmira, N. Y., assignor to Hartford-Empire Company, Hartford, Conn. Filed 3/28/28. The combination with a tunnel lehr having an opening at the receiving end thereof, of a radiation shield adjacent to said opening and outside said tunnel, said shield having an air passage extending therethrough, means for supplying air to the inlet end of such passage, said passage having an orifice at its outlet end for discharging the air away from said opening, and means for adjustably varying the vertical distance between said orifice and the floor of said tunnel when annealing glass articles of varying heights.

GLASSWARE BUCK. U. S. 1,802,928. Apr. 28, 1931. George E. Rowe, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Filed 7/29/27. In a glassware buck, the combination of a traction element, ware-supporting paddles connected to said traction element, means for varying the angle of inclination to the horizontal of the traction element, guide means for maintaining the paddles in a horizontal position during their load-bearing travel, and means whereby when the angle of inclination of the traction means is varied said guide means are simultaneously adjusted to maintain the horizontal disposal of the paddles.



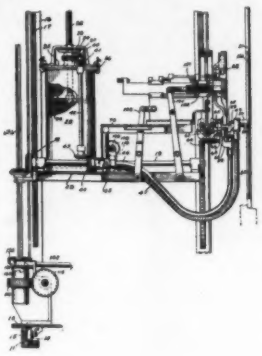
LITHOGRAPHER'S GLASS. U. S. 1,803,519. May 5, 1931. Edward A. Zeh, Passaic, N. J., assignor to Zeh Incorporated, Clifton, N. J. Filed 1/5/29. In the art of preparing a grained glass sheet for use in place of a lithographer's stone, the method which consists in applying to one face of a sheet of clear glass a coating comprising a mixture of zinc oxide, stannous oxide and a flux, and subjecting the glass so coated to a firing treatment at a temperature of about forty degrees Fahrenheit, lower than the temperature at which said coating would fuse to a smooth finish when applied to this particular glass.

GLASS-PLATE-FEED TRACK. U. S. 1,767,922. June 24, 1930. Richard Genenger, Aachen-Forst, Germany, assignor to The American Bicheroux Company. Filed 1/27/28. A bridge for a glass plate feed track, said bridge having a point of contact along one edge thereof and a narrower point of contact on the other edge.

GLASS HANDLING APPARATUS. U. S. 1,801,305. Apr. 21, 1931. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 2/3/28. Sheet handling apparatus comprising in combination, a pair of spaced suction members for engaging a sheet, supporting frame therefor, means for vertically slidably mounting said members for movement differential distances, and means connecting said suction members to a suction device.

GAS PRODUCER. U. S. 1,803,139. Apr. 28, 1931. Harry F. Smith, Dayton, Ohio, assignor to The Gas Research Company, Dayton, Ohio. Filed 6/26/22.

GLAZING MACHINE. U. S. 1,802,597. Apr. 28, 1931. Morris Glazer, Brooklyn, N. Y. Filed 7/5/29. A new automatically working window pane setting and puttying machine, the principal object of which is to provide a machine of this character adapted to set any size and number of windows into their respective frames to supply putty to the windows placed in the frame, press and smooth the putty. Also a motor operated machine of this character equipped with suitable means for guiding and swinging the puttying nozzle around all four sides of a pane set into a frame and suitable means for stacking and holding the glass panes prior to their setting.



APPARATUS FOR ANNEALING GLASSWARE. U. S. 1,803,031. Apr. 28, 1931. Vergil Mulholland, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Filed 3/11/26.

GLASS-HANDLING APPARATUS. U. S. 1,801,309. Apr. 21, 1931. John C. Gipe, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 6/27/29.

REFRACTORY. U. S. 1,802,296. Apr. 21, 1931. Paul G. Willetts, West Hartford, Conn. Filed 11/11/26. The method of making refractory bodies composed mainly of ceramically produced artificial mullite,

$$(3Al_2O_3.2SiO_2)$$

in homogenous combination with a relatively small amount of glassy matrix, and having a dense internal structure, which comprises the steps of grinding a natural mineral containing hydrated aluminum oxide to impalpable fineness, grinding a natural silicious clay to impalpable fineness, the fineness of such grinding being such as to enable said ingredients to combine with substantial homogeneity, intimately mixing said ingredients in selected proportions and in the presence of water, burning the mixed materials to a temperature sufficient to cause said silicious and aluminous material to combine ceramically to produce mullite ($3Al_2O_3.2SiO_2$), reducing the resulting material to sufficient fineness to form a grog, assembling said grog with additional mixed raw material similar to that from which said grog was made, to provide a dry mass insufficiently plastic to be molded by ordinary wet molding methods, forming the said assembled materials into the final shapes desired by dry pressing, and firing the articles so produced to a temperature sufficient to cause the added silicious and aluminous material to combine to produce mullite ($3Al_2O_3.2SiO_2$) and to destroy the identity of the original starting materials.

REFRACTORY. U. S. 1,802,297. Apr. 21, 1931. Paul G. Willets, West Hartford, Conn. Filed 12/11/26. Process of making refractory bodies composed mainly of ceramically produced mullite.

REFRACTORY. U. S. 1,802,298. Apr. 21, 1931. Paul G. Willets, West Hartford, Conn. Filed 3/14/27. A refractory body made by burning a mixture of a previously burned bauxitic clay grog and a binder containing bauxitic clay and diaspore.

GLASS FEEDER. U. S. 1,802,072. Apr. 21, 1931. Albert R. Bethel, Huntington Park, Calif. Filed 9/22/27.

SHEET GLASS APPARATUS. U. S. 1,802,142. Apr. 21, 1931. Albert E. Evans, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. Filed 7/26/28. The combination with a pair of rolls for forming sheets of glass successively in ribbon form from bodies of molten glass, a vertically movable runway extending forwardly from the rolls and provided with means for carrying the glass ribbons therealong, and a plurality of roller lehr sections or units in advance of the runway, one above the other, and means for operating the rolls of the runway and those at the entrance of the lehr at a relatively higher speed than the rolls following the entrance rolls and extending through the body of the lehr, the said runway being mounted so that its outlet end may be brought into alignment with any one of the lehr sections or units.

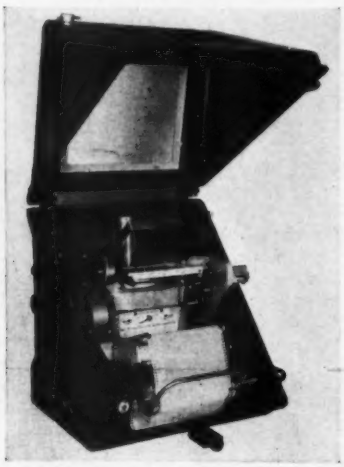
The Glass World and What It Is Doing

News of the Industry

Improved All-Electric Operated Pyrometer

A new series of improved Tapalog recording pyrometers equipped with complete electric power is announced as now in production by the Wilson-Maeulen Company, Inc., 385 Concord Avenue, New York. Both single and multiple record models have been extensively improved and simplified in mechanical design.

This new apparatus is made for any number of records from 1 to 6, for either base metal or rare metal thermocouples and for various temperature scales up to 3,000° F. and equivalent C. scales. The chart in the improved design is six inches wide for either single or multiple records. In both single and multiple tapalogs the depressor prints the records every twelve seconds. In multiple record machines the thermocouple connections switch after three depressions or after 36 seconds on one couple. Multiple recorders of fewer records than six have a correspondingly greater frequency of cycle.



They are operated entirely by an industrial type synchronous electric clock motor which operates on alternating current power from the lighting circuit or plant power. The multiple record Tapalogs have a fast cycle of record so that each record is made with greater frequency. The makers state that unusual sturdiness and simplicity characterize these instruments. All models are designed for automatic electric cold junction compensation.

A new catalog section "N" describes models of the new series now offered including pyrometers employing thermocouples and electric resistance thermometers employing electric resistance bulbs of both single and multiple record types. Model 8501 recording electric thermometer with single record wide chart is described in a new catalog section "S" now available.

Other features of the instruments are described in the catalogs referred to above, obtainable from the manufacturer at the address given above.

Distribution of Mirror Sales, 1929

Manufacturing plants engaged primarily in the making of mirrors sell their products largely to wholesale and retail dealers, and to industrial users such as manufacturers of furniture. Data collected by the Census of Distribution show that of the total sales in 1929 amounting to $31,890,000, 32.3 per cent, or $10,315,000, was sold to wholesale dealers; 21.3 per cent, or $6,807,000, to retail dealers; and 37.7 per cent, or $12,010,000, to industrial users such as manufacturers of furniture, etc.

Factories sold 6.2 per cent, or $1,983,000 worth of goods to their own wholeale branches for distribution by these branches to wholesale and retail dealers, and to users.

Other channels used were as follows: to household users, 1.8 per cent, or $560,000; and to manufacturers' own retail branches, .7 per cent, or $215,000.

Sales through manufacturers' agents, selling agents, brokers, and commission houses amounting to $1,916,000 were reported by 32 establishments.

The total sales as shown above include $720,000 worth of jobbing done by manufacturing plants, which sum is not included in the value of products as reported to the Census of Manufactures. Contract work (labor performed on materials owned by others) amounting to $673,000 is not included in the sale figures, but is a part of the value of production accepted by the Census of Manufactures.

The 304 establishments included in this report are primarily engaged in the manufacture of framed and unframed mirrors of plate or other glass. The report also covers the sale of $8,053,582 worth of plate glass beveled and polished, stained and leaded glass, wind shields, etc., made by these establishments.

Information concerning the value of the different kinds of mirrors as well as other facts on the industry may be found in the preliminary report issued by the Census of Manufactures, September 4, 1930. A copy of that report will be furnished free upon request to the Census Bureau.

Summary—Sales, 1929, by Manufacturing Plants in the Mirror Industry:

	Selling Value (F.O.B. factory)	Percentage of Sales	Number of Plants
Total	$31,890,000	100 %	304[1]
Sales to manufacturers' own wholesale branches[2]	1,983,000	6.2%	33
Sales to manufacturers' own retail branches[2]	215,000	.7%	17
Sales to dealers:			
Wholesale	10,315,000	32.3%	147
Retail	6,807,000	21.3%	134
Sales to users:			
Industrial (manufacturers of furniture, etc.)	12,010,000	37.7%	112
Household	560,000	1.8%	52

[1]The total number of establishments engaged primarily in the manufacture of mirrors is 304. Inasmuch as some establishments sell to more than one type of customer, this figure is less than the total of the figures shown below it.

[2]This report does not cover sales by manufacturers' own branches to dealers and to users, nor does it cover the sales by these branches through manufacturers' agents, brokers and commission houses.

Revised Census Figures for 1929

The revised census of the glass and glassware industries for 1929, a preliminary report of which was reviewed in the February, 1931, issue, was later released by the Bureau. A larger decrease in the number of establishments is shown in the revised figures, the total number of factories being 263, compared with 269 in the year 1927. Wages, however, increased over $5,000,000 during that period. The cost of materials was approximately $6,000,000 less in 1929 than in 1927. Total value of products, $303,818,560, in 1929 was approximately $21,000,000 over that of 1927. The value of the total production of glassware in 1929 came within $283,000 of the $3,000,000,000 mark, an increase of 8.5% in the two years period, the small balance of the entire production by glass factories being made up of $4,101,497 other products. The value added to raw materials by manufacture in 1929 was $200,424,617. The report in Table 2 gives detailed production figures for glass and glassware by kind, quantity and value, classified according to the character of the ware.

Pittsburgh Plate in Chemical Manufacturing Project

Official announcement was made April 27, 1931 by the directors of the Southern Alkali Corporation at a meeting held in New York, authorizing the exercise of options on 350 acres of land at Avery Point near Corpus Christi, Tex. The Southern Alkali Corporation is a new company recently organized by the Pittsburgh Plate Glass Company and the American Cyanamid Company, two of the world's largest manufacturing organizations in their respective fields. It is said that the project involves the construction of a ship canal nearly two miles in length to be dredged from the present Corpus Christi turning basin west to Avery Point and the dredging there of a second turning basin large enough for the use of ocean liners.

New Engineering and Construction Company

R. E. J. Summers, who until recently was vice-president and contract manager of The H. K. Ferguson Company, has resigned to become president of Summers Engineers & Constructors, Inc., with offices in the Terminal Tower Building, Cleveland, and in the Graybar Building, New York. The Cleveland office is to be managed by Charles H. Fowler, who assisted Mr. Summers in his former connection.

During the past five years Mr. Summers, it is stated, has obtained contracts and directed engineering and construction for business amounting to over $30,000,000, including large operations in the United States, Canada, and the Orient, for General Electric Company, Western Electric Company, Carbide and Carbon Chemicals Corporation, Ford Motor Company, American Enka Corporation, The Procter & Gamble Company, and Westvaco Chlorine Products, Inc.

Glass Container Association Annual Meeting

The annual meeting of the Glass Container Association at The Green Briar Hotel, White Sulphur Springs, W. Va., on May 7 and 8 brought out an attendance of about 30 of the members and there was also present almost as large a number of supply and equipment representatives.

Owens-Illinois Interests in California

Announcement has been made at Toledo, O. that a new company has been incorporated in California under the title Owens Illinois Glass Company, Limited by William E. Levis, president of the Owens Illinois Glass Company, H. G. Phillips and Harold Boeschenstein, to manufacture glass in that state.

Consolidated Feldspar Buys California Mill

Announcement has been made at Los Angeles that the Consolidated Feldspar Corporation of Trenton, N. J. has acquired the grinding mill of the Flynt Silica & Spar Company at 1047 Richmond Street, in that city. The Consolidated Feldspar Corporation operates mines and mills at Trenton, N. J., East Liverpool, O., and feldspar mines in North Carolina and several other states. It is said that ground silica will be a feature of the company's new California factory.

Polished Plate Glass April Production

The production of polished plate glass as reported on May 25, by P. A. Hughes, secretary of the Plate Glass Manufacturers of America, in the United States for the month of April 1931 was 10,173,666 sq. ft., as compared to 10,592,923 sq. ft. produced in the preceding month, March 1931, and 11,429,728 sq. ft. produced in the corresponding month last year, April, 1930.

Society of Glass Technology Election

At the 14th annual meeting of the Society of Glass Technology, Sheffield, England, the following officers were elected: Edward Meigh, president; Joseph Connolly and J. H. Webster, vice-presidents; W. Butterworth, Jr., F. Graves Clark, F. G. Orme, M. Parkin, W. J. Rees, ordinary members of council; B. P. Dudding and F. C. Flint, treasurers; Prof. W. E. S. Turner, secretary.

The Libbey-Owens Ford Glass Company, Toledo, O., is operating its East Toledo plant at full capacity, 24 hours a day. Credit is given to the increasing sales of laminated safety plate glass which have been large enough to warrant the resumption of manufacturing operations at its Lancaster, O. plant and increasing production in the large Charleston, W. Va. plant. The Ford Motor Company recently announced that laminated glass windshields would be standard equipment for all Ford cars and that the same type of safety glass would be furnished for doors and windows at a small additional cost.

Laminated Glass Manufacturing Company, 618 St. Jean Avenue, Detroit, Mich., was incorporated with $50,000 capital and 50,000 shares of no par value. David E. Hokin, 1475 W. Boston Boulevard, Max Unger and Howard J. Nelson are interested.

Braun Corporation, Los Angeles, Cal., long established dealers in laboratory supplies and commercial chemicals has begun the construction of a new $250,000 building. The main structure will be 85 x 327 feet. A second unit will be 70 x 85 feet, for acid storage.

Coming Meetings

American Glassware Manufacturers, Inc., will meet on July 13, 1931, at Atlantic City, N. J.

The Illuminating Engineers Society's 25th annual convention (celebrating its silver anniversary), Pittsburgh, Pa., October 13-16 inclusive, headquarters, William Penn Hotel.

American Bottlers of Carbonated Beverages, as announced by National Secretary, Junior Owens, Washington, D. C., will hold their annual convention and exposition at Dallas, Texas, November 9-13. Among the bottle manufacturers exhibiting the products will be the Laurens Glass Works, Inc., Laurens, S. C.; Owens-Illinois Glass Company, Toledo, Ohio; Root Glass Company, Terre Haute, Ind.; Three Rivers Glass Company, Three Rivers, Texas. Oakite Products Company (makers of cleaners), New York, will also be there.

Inquiries Received

For further information address THE GLASS INDUSTRY.

549. I am anxious to get in touch with commercial glassware manufacturers in order to obtain quotations on certain new types of laboratory glassware which I desire to secure.

550. We would like to obtain the names and addresses of companies who would be in a position to quote on machinery for making electrical bulbs, drug store glassware and jars for preserves.

551. Can you refer us to a manufacturer of glass such as used in making washboards?

552. Can you give us the names of the best manufacturers of special glue for chipping glass?

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C. For further information write the department.

Egypt—51725. Glassware, dishes, pots, jugs, bowls, basins, pans, etc.

South Africa—51594. Glass milk bottles.

Brazil—51476. Glass and chinaware.

Canada—51589. Glass and chinaware, and other hotel and restaurant supplies.

India—51436. Flashlights, unit cells, battery and bulb making machinery.

Canada—51371. Bottles for liquid shampoo.

Readers Wants and Offers

Address answers to all "keyed" ads c/o The GLASS INDUSTRY 24 West 40th St., New York

PRODUCTION MAN FOR BOTTLE PLANT

WANTED: Production man to take charge of day shift in bottle plant using Lynch machines. Must have real ability. Mold shop experience desirable. Give references. Address "Class. JU.-1."

SITUATION WANTED

By Glass Technologist and Engineer, as factory manager now employed. Many years' experience on both plain and colored glass, tanks and pot furnaces. Would like to get in touch with some progressive company who wants to do things. Address "Class MY-2."

EXPERIENCED GLASSHOUSE MAN

With 20 years' experience in glasshouse engineering, building and operation; expert on colors either pot or tank operation: all types of fuel; can handle men and insure production; experienced in hand and machine operation either blown or pressed ware; temperate habits; desires position with progressive glass concern or engineering firm. Address "Class. MY-3."

BACK NUMBERS WANTED

Will pay moderate premium for copies in good condition of THE GLASS INDUSTRY. Vol. 12, January, 1931, December, 1930, issue. Address THE GLASS INDUSTRY.

Current Prices of Glass-Making Materials

May 21, 1931

Quotations furnished by various producers, manufacturers and dealers

Acid		Carlots	Less Carlots
Citric (dom.)	lb.	.37	.37
Hydrochloric (HCl) 20° tanks, per 100 lb		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	..
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	..	.31½
Alcohol, denatured	gal.	..	..
Aluminum hydrate ($Al(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb.	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.19
Ammonia water (NH_4OH) 26° drums	lb.	.02½	.02¾
Antimony, metallic (Sb)	lb.	..	.09¾
Antimony oxide (Sb_2O_3)	lb.	..	.09¾
Antimony sulphide (Sb_2S_3)	lb.	..	.14
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.04½
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	47.00	..
90% through 100 mesh	ton	44.00	..
Barium hydrate ($Ba(OH)_2$)	lb.	..	.05¼
Barium mixture, glassmaker's, f.o.b. St. Louis	ton	25.00	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	..	.07¼
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	15.00-16.00	18.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	..	.0355-.0425
Crystal	lb.	.028-.032	..
Granulated	lb.	.025-.03	..
Powdered	lb.	.02875-.03375	..
Boric acid (H_3BO_3)	lb.	.0625-.07125	.0625-.08125
Refined	lb.	.0625-.07125	.07125-.08125
Cadmium sulphide (CdS)—			
Red	lb.	..	.65-.90
Orange	lb.	..	.65-.90
Yellow	lb.	..	1.30-1.50
Chromium oxide (Cr_2O_3)	lb.	.23	.24
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	1.70-1.85
In 10 lb. tins	lb.	..	1.85
Copper oxide			
Red (Cu_2O)	lb.	..	.25
Black (CuO)	lb.	..	.17-.19
Black prepared	lb.	..	.22
Cryolite ($Na_3Al F_6$) Natural Greenland Kryolith)	lb.	.09	.09¼
Synthetic (Artificial)	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.20
*Feldspar—			
100 mesh	ton	12.00-18.00	13.50-20.00
80 mesh	ton	11.00-11.75	14.50
40 mesh	ton	11.00	13.50
20 mesh	ton	10.00	10.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Imported	ton	36.50	38.50-40.00
Formaldehyde	lb.	..	.07
Graphite (C)	lb	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb	..	.0450
Black (FeO)	lb	.04½	..
Kaolin (f.o.b. mine)	ton	8.00-9.00	..
English, lump, f.o.b. New York	ton	14.50-25.00	24.50-30.00

Kryolith (see Cryolite)		Carlots	Less Carlots
Lead chromate ($PbCrO_4$)	lb	..	.30
Lead oxide (Pb_3O_4) (red lead)	lb	.07	.08
Litharge (PbO)	lb.	.06	.07
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	7.00	7.00
Burnt (CaO) ground, in bulk	ton	6.00	..
Burnt, ground, in paper sacks	ton	8.00	8.00
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	..
Limestone ($CaCO_3$)		1.75-2.50	1.75-2.50
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb	.06	.07
light (in bbls.)	lb	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.10
Manganese 85% (MnO_2)	lb.	.03	.03
Nickel oxide (Ni_2O_3), black— for nickel content	lb	..	.35
Nickel monoxide (NiO), green— for nickel content	lb	..	.35
Plaster of Paris, bags	ton	21.00	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.09	.09¼
Ground	lb.	.11	.12
Potassium carbonate—94-96%	lb.	.0555	.0555
Calcined (K_2CO_3) 96-98%	lb.	.06½	.07¼
Hydrated 80-85%	lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4)	lb.	..	.28-.32
Potassium hydrate (KOH) (caustic potash)	lb.	.07¼	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.06½-.06¾
Potassium permanganate ($KMnO_4$)	lb.	.16	.17
Powdered blue	lb.	..	.195
Rochelle salts, bbls.	lb.	..	.19
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	1.80
Silver nitrate ($AgNO_3$)	(100 oz.) per oz.	..	.22
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.07½	..
In barrels	Per 100 lb.	1.38	1.90-2.00
In bags	Per 100 lb.	1.17½	1.72½
Spot orders	.025 per 100 lbs. higher	..	..
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.50	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03¾	.04½
95 per cent.	Per 100 lb	2.01½-2.05	2.06½-2.10
Sodium selenite (Na_2SeO_3)	lb.	..	2.00
Sodium fluosilicate (Na_2SiF_6)	lb.	.04	.04½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50-1.55
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.37½	.39
Tin oxide (SnO_2) in bbls.	lb.	.28	.30-.35
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	..	2.75
Yellow	lb.	..	1.50
Zinc oxide (ZnO)	lb.	.08½	.12
American process, Bags	lb.	.06½	.07
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

*Spot Shipments.

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to April 24, 1931.

	March 1930 Quantity	March 1930 Value	March 1931 Quantity	March 1931 Value	Three Months Ending March 1930 Quantity	Three Months Ending March 1930 Value	Three Months Ending March 1931 Quantity	Three Months Ending March 1931 Value
Glass and glass products (Total)	.....	$809,821	.....	$822,273	.....	$2,302,326	.....	$2,104,019
Plate and window glass—								
Window glass, common, box 50 sq. ft.	1,019	6,399	973	5,624	4,533	24,845	2,302	12,386
Plate glass, unsilvered, sq. ft.	293,815	88,313	444,411	144,801	631,555	212,228	1,224,960	373,811
Other window and plate glass lbs.	480,776	55,314	224,656	38,548	1,386,345	130,737	898,120	98,120
Glass containers (bottles, vials and jars)	.....	234,362	.....	233,062	.....	694,199	.....	586,760
Table glassware, plain	.....	111,500	.....	100,497	.....	321,603	.....	244,522
Table and other glassware, cut or engraved	.....	9,770	.....	11,167	.....	25,632	.....	19,068
Lamp chimneys and lantern globes lbs.	.....	17,018	.....	8,399	.....	54,248	.....	30,439
Globes and shades for lighting fixtures lbs.	.....	58,332	.....	49,643	.....	168,710	.....	122,429
Chemical glassware lbs.	19,957	17,941	12,985	12,044	61,602	55,245	37,643	38,416
Electrical glassware, except for lighting lbs.	417,399	33,000	146,555	11,268	1,233,808	92,909	391,843	31,907
Other glassware	.....	177,872	.....	207,220	.....	521,970	.....	546,161

IMPORTS

Corrected to April 24, 1931.

Glass and glass products	.....	$724,202	.....	$581,258	.....	$2,428,413	.....	$1,545,994
Cylinder, crown, and sheet—								
Plain dut. lb.	2,123,630	79,827	979,975	44,695	7,181,822	272,532	2,958,289	117,464
Bent, beveled, colored, etc. dut. lb.	.....	32,275	281,926	34,447	.....	108,039	607,458	75,891
Plate glass dut. sq. ft.	520,048	118,291	446,773	136,456	1,976,813	439,807	1,254,031	363,518
Glass mirrors	.....	.....	236	447	.....	.....	428	834
Rolled, cylinder, crown, and sheet glass, ground, obscured, bent, beveled, colored, etc.	.....	.....	.....	1,910	.....	.....	.....	11,428
Laminated glass and manufactures, and plated glass	.....	.....	.....	2,420	.....	.....	.....	3,716
Bottles, vials, jars, and other containers	.....	132,356	.....	61,184	.....	367,137	.....	141,941
Scientific articles and utensils dut.	.....	56,603	.....	29,838	.....	145,989	.....	85,089
Tubes and rods dut.	.....	.....	.....	14,701	.....	.....	.....	32,290
Illuminating articles dut.	.....	30,835	.....	27,384	.....	193,074	.....	94,672
Blown glass articles—								
Bulbs for electric lamps, without filament dut.	819,744	6,835	1,532,715	14,164	3,771,929	32,485	4,104,787	38,084
Other blown glass articles dut.	.....	172,925	.....	127,450	.....	543,680	.....	356,345
Pressed glass articles	.....	13,145	.....	14,099	.....	47,897	.....	35,903
Other glassware	.....	81,110	.....	72,063	.....	277,773	.....	188,819